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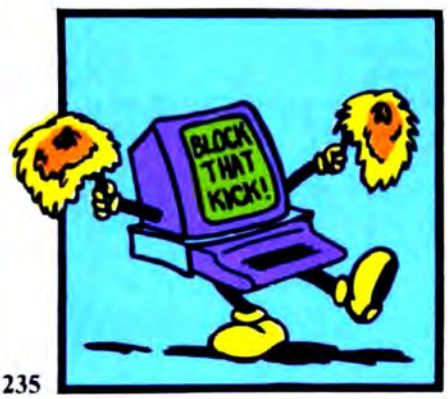
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COVER art © by Fred Crawford

Due to family illness, Dennis Lewandowski's *Assembly Corner* column does not appear again this month. It will return in September.

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NEXT MONTH: September means back to school (already?) and that means *the Rainbow* will have a special emphasis on education. Plus, Steve Blyn's *Education Notes*, Dr. Michael Plog's *Education Overview* and Dale Peterson's *Greetings From Uncle Bert*, our own LOGO column.

Our memory map will feature disk BASIC, we'll offer a *Superpatch* for EDTASM, an appointment book and a new video worksheet.

Plus . . . more games, more utilities and just more of everything — programs, reviews, and information on CoCo than you can possibly find *anywhere* else. Don't miss the September *Rainbow*!

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The Rainbow is published every month of the year by FALSOFT, INC., 9529 U.S. Highway 42, P.O. Box 209, Prospect, KY, 40059. Phone (502) 228-4492. **The RAINBOW** and the Rainbow logotypes are ® Trademarks of FALSOFT, Inc.

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Subscriptions to **the RAINBOW** are $22 per year in the United States. Canadian and Mexican rates are U.S. $29. Surface mail to other countries is U.S. $57, air mail U.S. $85. All subscriptions begin with next available issue.

Limited back issues are available. Please see notice for issues which are in print and costs. Payment accepted by VISA, MasterCard, American Express, Cash, Check or Money Order in U.S. currency only.

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letters to RAINBOW

RAINBOW ON 'RECORD'?

Editor:

It is a splendid effort, the 2nd Anniversary issue, and the tipped-in record a brilliant thought. My boys would not object to a rise in the subscription rate, equivalent to a monthly *Rainbow on Tape*, if that helps to guide your decision—so long as the Soundsheet could be made to contain an equivalent amount.

As for the CGP-115 and Katakana, I have never touched Switch Four at all, but I have found that that syllabary can be entered directly from BASIC, with PRINT#-2, CHR$(X) where X is above 128. I am not going to stop everything now to refresh my memory of the exact numbers. Why, by the way, do you suppose the Japanese never include the Hiragana on these chips? There's a set of characters which could be put to some real use in the world. There was room enough on the CGP-115 for all the variant forms, I think.

R.W. Odlin
Sedro-Woolley, WA

TRY THE TRS TRIPTIK

Editor:

I find from various articles and advertisements that *Rainbow* has a wealth of information on different aspects of programming. For instance, I gather from the article *Write an ML Program to Handle* BASIC *Chores* that you have the information on addresses of various ML routines. I also find that you have complete information on *POKEs* and *PEEKs* that we seldom find in one place.

One of the problems I have not been able to get a solution to, except to go in for some kind of toolkit is to protect my BASIC programs from being listed after initial loading from the tape or after *BREAK*ing. Maybe this piece of information was published in one of the earlier issues of *Rainbow* but I am so far in the dark.

Monohar Santwani
Fairport, NY

Editor's Note: See Bob Russell's Memory Map in this and other issues.

INFORMATION PLEASE

Editor:

I am a stamp collector and I'm looking for a program that will work on the CoCo. Can someone help? I know that there is one available for the Sinclair, but, I haven't heard of any others. Please send a reply to: C-M Enterprises, P.O. Box 187, 61071.

Connie
Rock Falls, IL

Editor:

I have had an adventure game called *Pirates Ahoy* by Spectral Associates for some time now and I am approaching the brink of insanity!

Can anyone give some hints to a poor, frustrated, adventure novice that can't get out of the first five rooms?

If anyone can give me some clues (or even the solution) to this tough adventure, please send them to: Matt McMann, 22550 Dickinson Rd., 48164. Your help will be greatly appreciated.

Matt McMann
New Boston, MI

Editor:

Is there any way that human-like figures can be drawn using the CoCo's graphic routines? Everytime I try to do it they end up looking like stick figures. I would like to have them look more like people.

I have two books on Color Computer Graphics but I am having a hard time understanding how the graphics are supposed to work.

Bob Chase
Concord, NH

Editor:

I wonder if any of your readers could help me out. I am a graduate student at Penn State University and am in need of any programs for the CoCo that could help me with statistical anlalysis. For example, anything for determining confidence intervals, standard errors, slope formula, correlation coeficent, z score or anything else that might be useful. I will appreciate any help anyone might offer. My address is: 268 Toftress Ave., Apt. 321, 16801.

James E. Pendorf
State College, PA

Editor's Note: You might find interesting reading in "A 'Nova' For CoCo," an article and program on the statistical analysis of variance by Sam Sherrill. It was published in the March 1983 issue of *the Rainbow*. You'll find it on page 94.

SHED SOME LIGHT?

Editor:

Your April issue contained an excellent article by William C. Clements, Jr., on the addition of a "Power On" light to the CoCo. I was wondering whether any of you electronic experts have a suggestion on how to add a power on light to Radio Shack's disk drive. The present light only comes on when the disk is in actual operation and I find myself forgetting to turn it off more often than CoCo itself.

Chris L. Shelby
Lebanon, IN

Editor:

In your June 1983 edition of *Rainbow*, Letters to the Editor section, there was a letter asking for any information concerning an adapter to convert from TRS-80 to Atari.

I am very interested in any response you receive concerning this letter. Where I work we have two large TRS-80C and Atari groups and are trying to communicate between both systems.

James Downey
Framingham, MA

WHEN THE CHIPS ARE UP

Editor:

I have recently read in the March issue of *Rainbow Pipeline* that there is a VDG chip being developed that could enable the CoCo to have a numerous 4,000 colors, 700 x 500 pixel high-res graphics screen, and a 64 character screen display on the horizon. I want to know if this is true and where this chip will be sold?

I'm very happy with my CoCo, but when I found out how many colors the Atari 400 and 800 computers had, I found my CoCo was missing something!

I feel this VDG chip (if there is one) will help out the CoCo and its owners a great deal.

Also, I enjoy your magazine a lot and look forward to it each month, so please keep up the good work.

Dan Dipierro
Jamesburg, NJ

Editor's Note: We hear rumors to that effect and will report our findings as soon as something is finalized.

Editor:

As the addresses of the ROM subroutines of the Tandy CoCo and the Dragon 32 differ, I would ask if it is possible to publish a list of the addresses of the ROM subroutines of the Tandy CoCo versus the appropriate addresses of the Dragon 32.

T. Arnold Bik
Uilenstede 12 Netherlands

Editor's Note: Though we don't have such a list at this time, CompuSense of England has a new utility which should interest you. Look in this month's Pipeline column.

GROWING PAINS

Editor:

I have owned my CoCo since it was a 4K machine. I have watched it slowly evolve into its present 32K with disk configuration over the last two years.

I have reached the point where what was once a minor inconvenience is now an impediment to its future growth. I refer to the garbage collection habit with which my machine is afflicted.

I read *the Rainbow* very nearly from cover to cover and I have, to my bewilderment, not seen my particular problem addressed.

The specifics of my case: a) I have Radio Shack's line filter and only Radio Shack's computer center has ever worked on any computer upgrading and b) I have established through two years of use that I get trash in the machine during power drops, but not power spikes (ie, memory is altered when the electric furnace comes on, but not when it shuts off, etc.).

Where have I gone wrong? Why is my CoCo growing up with no more ambition than to be a garbage collector?

Charles F. Kerner
Kernersville, NC

Editor's Note: Any electronic device is susceptible to voltage fluctuations at the input, whether spikes (overvoltage) or dropouts (undervoltage). The line filter you mentioned will eliminate spikes but there is no economical way to eliminate dropouts. We may suggest a circuit directly connected to your electrical service panel, via a circuit breaker of course, as a pseudo solution. This circuit would not have the voltage drop present on a normal residential circuit.

I AM THE SYSOP

Editor:

I am the *Sysop* of the BULLET-80 system located in Rochester, NY. I have recently expanded my download section greatly and I was wondering if I could ask you a few questions.

First of all, for my new download section, I would like to have your magazine's programs in it!

Second, since I do not have a Color Computer to load the tapes in with, would there be a "middle-man" who has a Color Computer and could load these in and later upload them to me?

Harold Land
Rochester, NY

Editor's Note: Sorry, these programs are copyrighted and available on *Rainbow on Tape*.

KUDOS

Editor:

I am a relatively new subscriber to your magazine. In the past four months you continue to amaze me with the quality of your magazine. I find the hardware tips and hardware reviews of particular interest. The large number of advertisers is a definite asset to your magazine.

I am a high school science teacher and have access to several different computer systems and many periodicals. Your magazine is the best there is on the CoCo, which says your product is the best of all the microcomputer journals.

If you change any part of the magazine it should be to add more on the hardware, but the present mix is quite good. I have found your reviews to be excellent and use them as a guideline in my software purchases.

Thanks again for an excellent magazine.

David Loveless
Trenton, NJ

Editor:

Congratulations on your recent upgrade of the cover design. Each issue seems to be an improvement over the last. Keep up the good work.

Charlene Merrill
Ft. Lauderdale, FL

WANTS SOME POINTERS

Editor:

I have had my CoCo a year since April and have enjoyed it greatly. Since I got my computer I have spent very little time with my amateur hobby, but do enjoy the articles for the amateur hobbyist and have copied them.

I would like to get into machine language and was wondering if it would be possible to run articles that tell a person what they need or how to get into machine language? Would it also be possible to make this article start out simply, if possible?

I do enjoy *the Rainbow* and was glad that I found your magazine, although it makes a wife a widow when it shows up in the mail. Keep up the good work and I like to see those Canadian articles in there.

W.S. Goheen
Timmins, Ontario

Editor's Note: For a start, read Dan Downard's and Dennis Lewandowski's columns in *Rainbow*.

PEN PAL FOR A WRITER

Editor:

I am interested in pen pals. I own a TRS-80 CoCo and a TRS-80 Model II Computer/Word Processor.

I'm a bored to tears freelance writer. Can any pen pals out there tell me how to make money at home with my computers? Over 40, M.A. in creative writing and seeking new career in computers. I've authored 29 books. My address is: P.O. Box 4333, 92104.

Anne Jorgensen
San Diego, CA

OLD TV CALLED A HAZARD

Editor:

In your April issue, reader Charlie Muncy inquired about harmful radiation for old TVs. There is indeed such a hazard, and I refer you to a letter to the editor in the September 1982 issue of *The New England Journal of Medicine.*

It has been found that pre-1970 TVs can cause X-ray exposure higher than the recommended maximum dose. The recommended dose limit is 500 millirem per year for organs especially sensitive to radiation, such as the thyroid. Old TVs used two hours per day at short distances, as with a microcomputer, could result in exposure as high as 890 millirem per year to the eyes and 779 to the thyroid. See also the February 1983 issue of *FDA Consumer.*

Since 1970, the FDA's performance standards for TV receivers have been in effect, so emissions have been sharply reduced by manufacturers so as to be in compliance.

Richard Riffer
Berkley, CA

Editor:

This is in regard to the letter from Charlie Muncy concerning radiation from older color TVs. I heard the same thing reported on the TV news. I believe it was from a government agency, maybe the Surgeon General's Office. The report stated that older TV sets give out more radiation than the newer sets. The problem with video games and home computers is that the user is usually sitting close to the TV and so exposing himself to possible higher than recommended levels of radiation. It would be better for all who own older TVs to sit at least eight feet from the set.

Joseph S. Paravati
Yorktown Heights, NY

CALL ANYTIME

Editor:

Please announce that the Sangarnet Bulletin Board is now on-line 24 hours a day, 7 days a week. Sangarnet is a free bulletin board which features uploading, downloading, electronic mail, bulletins, and much This 300 Baud Bulletin Board also features System Chess, a new concept in electronic computer bulletin boards. Sangarnet can be accessed at (919) 758-5261.

Gary L. David
Greenville, NC

WHICH WAY TO 64K?

Editor:

I own a Color Computer, 32K Extended Color BASIC with 64K RAM chips; it has an "E" board. My question is how can I make my machine into a 64K system, or is it already? Would it require further hardware modifications or only software to access the full 64K of memory?

I have read most of this issue's (April 1983) articles and ads. I found one article of particular interest to me, which prompted me to write this letter. The article is about a program called *The 64K Screen Expander*, a software review by Dan Downard, on page 100. My main concern is, if I bought this program, could it run on my CoCo in its present state, or would the CoCo need some modifications?

I would highly appreciate any help I can get on this matter.

Gennaro D'Ambrosio
Revere, MA

Editor's Note: Gennaro, read on.

Editor:

I have had my CoCo for about a year after purchasing it second-hand from a friend. I

am not sure of its age but it is a 1.0 version and has a D board. I am considering a do-it-yourself upgrade and would like to know if my board can be upgraded to 64K or am I stuck with 32K? Also, the *POKE 65495,0* plays havoc with any *SOUND* statements which are included in some games. I understand this is common with some older CoCos, but I was wondering if there is any kind of fix.

John E. Duling
Las Cruces, NM

Editor's Note: Your board can be upgraded but you must have the 1.1 ROM to use 64K. See March *Rainbow*, page 100, "D-Board 64K Upgrade" by B. H. Alsop. The processor clock runs at twice its normal speed with the *POKE* you mentioned. Sound is a function of the clock speed as is the cassette and disk I/O.

LOOK FOR THE SEAL

Editor:

I have a TRS-80 Color Computer 16K BASIC (26-3004A) and wish to upgrade to 32K Extended BASIC. The cost of doing this in the U.K. is prohibitive, and in reading your *Rainbow* magazine I have seen various adverts for upgrade lists. These include Selected Software, Spectral Associates, Computerware, Jarb, Inc. Since they all vary and I have no knowledge of any of these companies I would be most grateful if you could recommend a reputable and reliable system. I would like a kit that is obviously simple to install and one that gives continuously reliable results.

D.A. Berle
London, England

Editor's Note: All of the companies you mentioned, plus several others, offer memory upgrade kits. Look for the *Rainbow Seal of Approval* to verify that these products indeed exist.

MORE THORNS, LESS ROSES

Editor:

I have become weary of most of the reviews in your magazine because, generally, they seem to paint too rosy a picture of the program under review. If the programs available now were available a year and a half ago, then I would agree with the reviews. But CoCo owners have become accustomed to a variety of good, enjoyable programs and expect quality. There are few exceptional programs.

Please try to impress upon all of your reviewers the need for an honest evaluation—good, so-so, and poor points—that is separate from an expression of enthusiasm or rejection (I know that can be difficult, and I know it is easy to criticize, and I know opinions vary). A review is for the benefit of the buying public, not the manufacturers; a review is an assessment, not an advertisement.

John Plaxton
Medley, Alberta, Canada

PATCHING PROBLEMS

Editor:

I agree with Mr. Kennedy's letter on Telewriter (it's great!), but the problem is I can't use it. I have a Silent-700 printer and can't patch my CoCo to print with it while using Telewriter. I have the original version of Telewriter, and can patch my CoCo to print while in BASIC, but not while in any machine language programs. I also have a problem with the spacing, upper- and bottom-margins (I can't get them to work with a Okidata Microline 82A). Can someone please help me?

I have seen samples from the new Okidata Microline 92, and it seems absolutely fabulous!

Mitch Cohen
Framingham, MA

Editor's Note: A letter to Cognitec would probably bring results. If you have a monitor with a "find" command search for all locations containing $A2BF in Telewriter and change this address to the location of your printer driver.

A DIFFERENT OPINION

Editor:

Your review of our program *Graphics Program Generator II* in the June issue gives heavy-handed criticism to our documentation, "... I wish I could say something good about the documentation..."

While we appreciate the praise the reviewer gives a number of features of the program itself, we believe a software product without adequate documentation is half a product! We flatly disagree with the reviewer's comments. The manual to *GPG-II* is indexed, clearly written, logically organized, contains listing examples and is nicely printed.

I have enclosed a copy of the manual in question and ask that one of your staff members offer your readers a second opinion.

Tom Mardis
Principal, CoCoDATA Enterprises
Orlando, FL

Editor's Note: In this case, our opinion does seem to differ with the reviewer. We judge the manual to *GPG-II* to be quite adequate and, in fact, much better than average documentation.

HINTS 'N' TIPS

Editor:

Maybe this will help Chris Woods to solve a problem with his 64K upgrade. Connect Pin 12 of U4 to Pin 16 of U8; this is what I did to get my 64K operating. The article uses the old and incorrect method of jumping Pin 12 of U4 to Pin 17 of U8—this has been reported to give just 4K. Otherwise, the procedure does work.

Also, I have come up with a disk conversion for "NO ESCAPE" July 1982 *Rainbow:* Change line 26 to read DATA 142,14,63, 166,128,167,136,191,140,37,236,45,246, 57,36

and change line 28 to read

```
NEXT:LINE(0,191)-(255,178),PRESET,
BF:PLAY"V26L26T9":DRAW"BM50,
191C4S4":R$="BY JIM EBBERT":
GOSUB20:FORDU=1TO999:NEXT:
PCLS:PCLS
```

These two changes should make a disk executable copy of the program. Thanks to Jim for writing in P.I.C. In addition, I have found that adding 2084 (decimal) to most well-written programs like Jim's will convert them over to disk. If any readers out there don't want to wait for my conversion of *Rainbow Roach* they could use this idea.

Jim O'Connor
Cambridge, MA

Editor:

I have just received my first issue of *the Rainbow* and I think it's a great magazine. I learned a lot from it and thought that your readers might appreciate this bit of information: If you have a Radio Shack ROM pak and you want the game to move faster, this is all you have to do:

1. Turn computer on
2. *POKE* 65315,54
3. Insert cartridge
4. *POKE* 65495,0
5. *EXEC* 49152

Ruben Lipszye
Sarnia, Ontario, Canada

Editor:

To get more men on *PitFall,* type: POKE&H2CBC,(1-255), after loading.

John Brissie
Greenville, SC

Editor:

I was very interested in the Text Editor Progrm "Mr. Ed" from the July issue. I found that the change command "C" was somewhat slow. I have rewritten the change logic to run faster. To add my changes, delete lines 880-1030 and insert the following four lines:

```
870 A=INSTR(X$,"/");IF A=0 THEN
  RETURN
880 B=INSTR(TX$(CL),LEFT$(X$,
  A-1)):IF B= THEN RETURN
890 TX$(CL)=LEFT$(TX$(CL),B-1)+
  MID$(X$,A+1)+MID$(TX$(CL),B+
  A-1)
900 RETURN
```

I hope you will have more articles on text processing in the future.

Kevin Davidson
Easley, SC

Editor:

I was pleased to read Judd C. Posner's fine article on the *Spectaculator* ROM Pack. I would like to pass along a few other *tricks* that I have found work well and help when preparing reports and printouts.

1. When it is desirable to repeat a column, multiplying by one will transfer it to the new column.

2. If a group of work sheets is necessary for a report, the sheets can be spread in steps over the available cells. As an example, the first work area could occupy columns 1 to 8 and rows 1 to 8 then the next area could be from columns 9-20 and rows 9 to 25 and so on. This allows for specific formulas for each area and can be saved to tape at one time. On

(continued on page 13)



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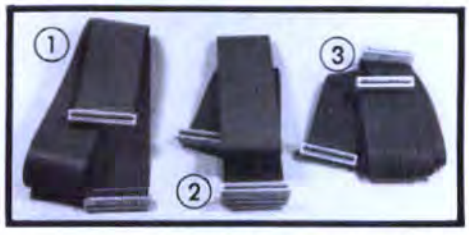
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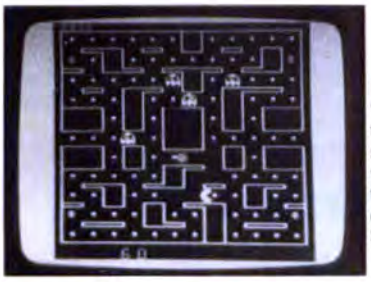
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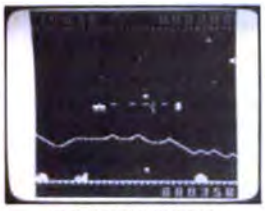
GHOST GOBBLER

DONKEY KING

DONKEY KING

You simply can not buy a more impressive game for your color computer than this new wonder from Tom Mix. The graphics, sound, and animation are all just astonishing! There are four different graphic screens and each is endless fun. Requires 32K. Tape: $24.95, Disk: $27.95





PROTECTORS

There are several good versions of the "Defender" theme available for the CoCo. None, however, rival this one from Tom Mix. No other game matches the detailed graphics and sheer excitement of this top seller. Requires 32K. Tape: $24.95, Disk: $27.95



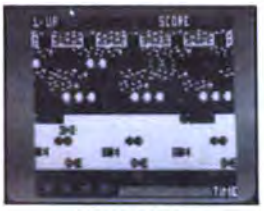
CREATURE FEATURE

From Color Software, comes a lightening swift shoot & dodge the enemy game. It's clever cross between "Robotron" and "Beserk" themes, with bullets flying everywhere. Solid, shoot-em-up-fun. Requires 16K. Tape: $17.95. Disk: $19.95



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Spectral Associates' very well done "Berserk" type game with some interesting added features. Each cassette contains both the 16K and 32K version. The 32K version has voice output! Plenty of action. Tape: $21.95



FROGGER

Just released by The Cornsoft Group, this is the officially licensed version from Sega, the arcade manufacturer. It has it all! 4 lane super highway, snakes, turtles, logs, alligators, etc. Lots of action and laughs! Requires 16K. Tape: $19.95



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a printout each area can be listed in a desired order to make a meaningful report.

3. When you do not want a calculated cell to print, by entering a text period (.) or dash (-), numbers will not be printed. This happens sometimes when the sum of a column or row is not a meaningful figure.

4. To consecutively number the rows in a column, you can generate a column of ones in the way Judd Posner suggested for zeros, then in the next column enter an integer SMT column formula.

I'm sure there are many more ways that this powerful program can be used. I for one would sure like to hear about them. *The Rainbow* is great.

G. Donald Jenkins
Camp Hill, PA

Editor:

A fast way to find all the unlisted lines—let the computer do it. Use RENUM.

Gerald Garhart
Sharon, PA

RANDOM?

Editor:

I have a 16K ECB CoCo and am writing regarding random number generation. First, turn on your CoCo and run this short program:

```
10 FOR X=1 TO 10
20 PRINT RND(10)
30 NEXT X
```

After you run this program, record all ten numbers. Then, turn off the CoCo and turn it on again, and run the same program. All the numbers are the same as the first time! (I got 50, 32, 14, 66, 45, 34, 56, 30, 11, 83.) My friend pointed this out to me and got the same numbers as I did. (He has 32K ECB.) This means that CoCo can't pick truly random numbers.

Kenny Miller
Yardley, PA

Editor's Note: Right, that is why they are called pseudo random numbers. But, through a process which has been explained on these pages before, you randomly select the pseudo random number with which you start—thus getting true random numbers anyway. See the letter below.

NOW HERE'S RANDOM

Editor:

Here are a couple of programming hints for those without Extended Basic. The RND(N) function is not random. The solution is easy with Extended Basic. Start each program with:

```
10 X=RND(-TIMER)
```

Note that it must be "-TIMER." Without Extended Basic, you can start with the following routine:

```
10 PRINT "TYPE X"
20 IF INKEY$ () "X" THEN CT=CT + 1:GOTO 20
30 X= RND(—CT)
```

This can be disguised in your program in many ways. If there is a simpler way, I would appreciate knowing about it.

Another major lack in Standard Basic is the SQR(N) function. There is, however, a simple algorithm which will accomplish the same result.

```
10 ANSWER=NUMBER/10
20 ERROR=(NUMBER/ANSWER + ANSWER)*.5
30 ANSWER=ANSWER + ERROR
40 IF ABS(ERROR)    NUMBER*.001 THEN 20
```

What falls out for ANSWER after 4 to 8 iterations is a very close approximation to the SQR(NUMBER). Try these, you'll like them.

David W. Cochran
Norristown, PA

BREAK, BREAK, BREAK

Editor:

Thank you for an excellent magazine! I am a paraplegic, an electronics tehnician and an amatuer radio operator. My amateur call is WDOHNF. I hear quite a bit of talk about CoCo on the ham bands. There is even supposed to be a net on 20 meters devoted to it, but I haven't been able to check in because the net is mostly an east coast function.

I would very much like to hear form other amateur radio ops with an eye to establishing some kind of net, perhaps on 75 meters. I also have info on how to go about using CoCo on RTTY, slow scan, and CW. I have appreciated the articles on amateur radio; but I would like to see more.

Randall Brink
Everett, WA

LONG LIVE THE KING

Editor:

This is to let readers know I have found a way to save high scores on *Donkey King.*

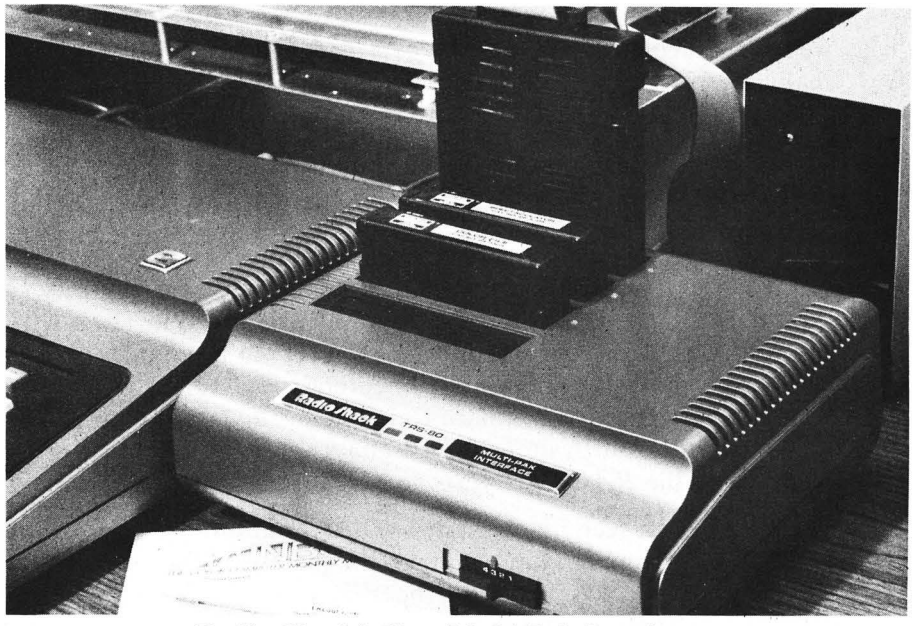
To accomplish this feat you need to load *Donkey King*, then *POKE* 12850,127, *POKE* 12851,0, *POKE* 12852,114. Then resave the game. To do this, type '*SAVEM* "Donkeyl",12803,&H7F00,12803' *ENTER* key for disk users. For tape users put a 'C' in front of *SAVEM (CSAVEM).* The rest is the same.

Now, when you get a high score in the high score table and you're through playing, hit 'reset' and you will be back in BASIC command mode.

Now for disk type '*SAVEM* "score",31670,31790,12803' enter, for cassette put a 'c' in front of *SAVEM.*

When you play again and want your high score back, first load *Donkey King*, then load score and *EXEC.* Your scores will now be reset. You must do this every time you want to save a high score.

Chris Latham
Grants Pass, OR

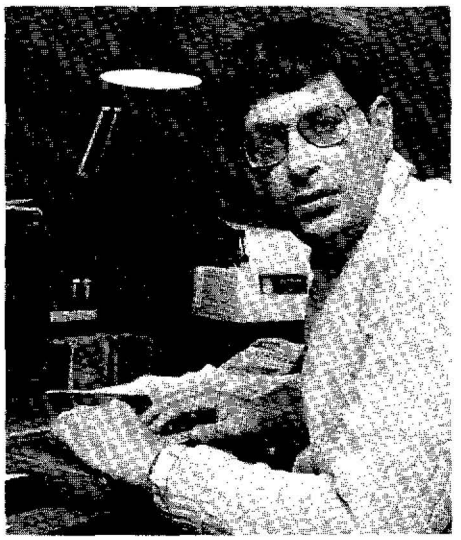


Radio Shack's New Multi-Pak Interface

Here is a first look at the new Multi-Pak Interface just announced for the Color Computer. It allows four Program Paks to be on line at a single time, including the disk drive controller and the X-Pad. The left-hand side of the Interface has an extension which plugs into CoCo's expansion slot. Any one of the four Program Pak slots can be selected by either hardware or software. Cost of the unit is $179.95.

An in-depth review of the Multi-Pak Interface will appear in next month's *Rainbow.*

PRINT #-2,



We're moving into *the Rainbow's* third year with this issue and, first of all, I really do want to thank all of you who were so kind to call and write us with good words about our second anniversary issue. The mailman was overburdened for a number of days with the letters and cards, and I certainly thank all of you for letting us know what you thought about the issue.

The jury is still out on the record. All of you, without exception, said that you liked it, but the feeling was mixed as to whether you would like to have a record every month or, at least, several times a year. We'll let you know what's happening as soon as we can decide.

While we were nursing *the Rainbow* into its third year, we were giving birth as well. The first issue of our new magazine for the TRS-80 Portable Computer —known now as *PCM —The Portable Computing Magazine* — went to the printer's and, by the time you see this, should be in the middle of its first month of life. I do hope you will check it out, because, more and more, I see the Portable Computer as a very excellent machine that has a great deal of potential.

Doing the first issue of *PCM* was an interesting and fun experience. One of the most interesting was the use of color in the magazine. Since issue Number One was only 32 pages, we were able to have color *available* on every single page. And, while the use of color for editorial purposes was so much less than is available in *the Rainbow* each month, the size of *PCM* makes it look simply loaded with color.

We actually have more pages of color available in *the Rainbow* each month than any other CoCo magazine has total pages! But, then, with more than 300 pages, it gets a bit spread out. In *the Rainbow* we try to space the color so that it gets used where it will look the nicest. Sometimes it isn't easy and it really is upsetting, sometimes, to have to go with black and white artwork on a really interesting program. We run so much color that it seems we could do almost anything we want, but we can't. We *do* hope, though, that you find *the Rainbow* to be an attractive publication, as well as an interesting and informative one.

It now appears that we will be sponsoring three — and possibly four —*RAINBOWfest* shows in the next year. One of them is set for the east coast — in the New York/ Philadelphia/ Boston general area. A second will probably be in Southern California, most likely somewhere in the San Diego/ Los Angeles area, although we are not counting San Jose out. The other "probably for sure" site is Chicago again. It was so successful this year, we *do* want to go back.

As to general times, it looks like September/ October for the east coast, January/ February for the west coast (that's why Southern California is high on the list) and very late spring for Chicago.

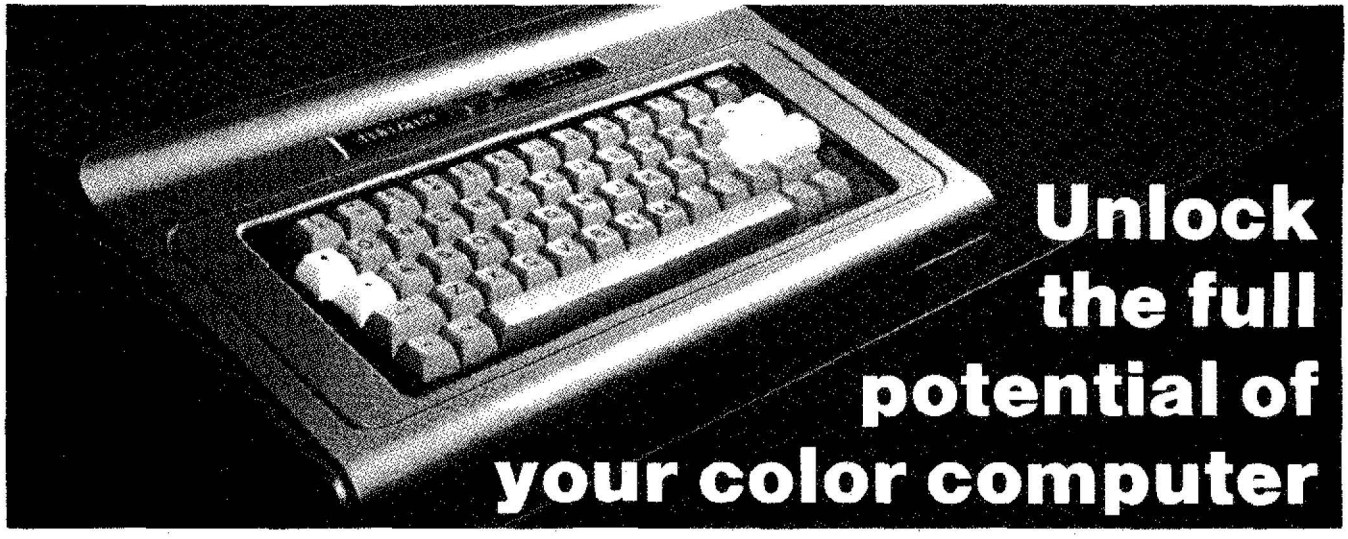
The possible fourth site? We'll just have to wait and see how negotiations go. But, plan to attend at least one of the *RAINBOWfests* next year. You'll be glad you did!.

You have not seen much mention of the *Rainbow Seal of Certification* lately, but we are pleased with the program and, judging from the mail we receive, you are, too.

We began the program after hearing "horror" stories associated with several other computer markets about people who advertised products which never saw the light of day—and which quietly died only after some people ended up with a lot of other people's money. We devised the *Seal* program simply because we believed such a repetition would harm the CoCo market, and we didn't want that to happen. Remember, though, the *Seal* is not a guarantee of satisfaction, it is merely a certification that a product does, in fact, exist.

Because the *Seal* was a *Rainbow* certification, we never asked anyone else to use it or accept it. Still, I am very pleased at the spirit of cooperation which has been a part of the CoCo market so far as the *Seal* has been concerned. To my knowledge, only one publication in the Color Computer field has refused to use

(continued on page 296)



Unlock the full potential of your color computer

It's easy with the right keys.

The HJL-57 professional keyboard instantly upgrades your TRS-80* Color Computer to a dependable, high-performance machine with all the capabilities of systems costing hundreds more.

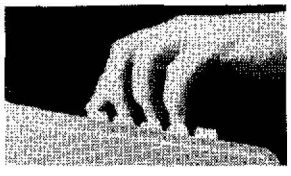
If you've ever tried to enter a major block of data or do word processing, you know that the keyboard is the major limitation of the color computer.

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Money-back guarantee	Yes	No	No

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BUILDING AUGUST'S RAINBOW

Beginning our third year . . . The fun and games issue . . .

I have just noticed that there are three TV sets on in my house. And, since there're only the two of us, this bears investigation. It turns out that my wife is in the back room watching *Outland* while, in the living room, two of our dogs are watching something called *Black Sunday*. In the "computer room," formerly the den, my word processing screen is watching me. Mostly, anyway.

Occasionally, I hit *CLEAR* "A" to clean up the copy and a *CLEAR* down-arrow to recenter the last line. Somehow, this sets me to thinking that we are not in so unique a situation. How many other families in America, and beyond, are gathered around the household TV sets and computer monitors?

Every month, more than 100 computers are used to produce *the Rainbow*. Really. Only a dozen of these are in the editorial offices here at Prospect; the rest are in homes scattered across the U.S., Canada and Australia. Think about it. The articles, programs—even letters to the editor—are generated on, and "written up" on, computers. Perhaps 95 percent of submissions arriving at *the Rainbow* are in machine-readable, magnetic media form.

What all this means is that the day of the electronic word has arrived at *the Rainbow*. While we haven't yet devised a way to hook electrodes to Don Inman's brain and patch a circuit directly to you, we can connect his innermost computer sanctum to our typesetting machine.

For the first time last month, this column you are now reading appeared in its final typeset, magazine format before ever touching paper! We hope that this will mean less slips "twixt the cup and the lip." Toward that end, we are asking regular contributors (and prospective ones) to submit not only their programs, but their articles as well, in ASCII format to be compatible with our typesetting system. While we still need a "hard copy" (as in double-spaced, typewritten, on paper), we're trading our green visors and blue pencils for green-screen CoCos and push-button editing.

Our focus this month is on games, and do we have a bagful—everything from brainbusting toughies to borderline mindless! We'll leave it to you to categorize them, but their style ranges from CoCo traditional (the *Enrak* Adventure) to MC-10 mod (Tom Szlucha's mini-duet written especially for the Micro CoCo). A personal favorite is *Auto Designer* by Joel Robbins.

As always, we have a full mix of CoCo offerings and a summertime special is Dennis Weide's *Cash Register* program, which he has tried and proven at many arts and crafts fairs. Also in this August edition, electrical engineer Dan Downard takes a look inside the new MC-10 Micro Color Computer. And cathode-ray tube test engineer Mike Dubuc wins this month's Roy G. Biv Award for his *Test Patterns*.

While September is our education issue, Dr. Michael Plog joins us this month as an education editor. His credentials are excellent. He is a program evaluator for the Illinois State Board of Education. In addition to reviewing interactive instructional use of the Color Computer, he intends to set up a system to evaluate software and to discuss development of materials, management of instruction, data exchange and administrative management of information.

Our CoCo Clubs section is new this month. While it may not be an every month feature, this section will be updated frequently—probably quarterly. If your club isn't on our master list or your club information needs updating, write.

Installments of several series continue in this issue, including our *QSORT* sorting utility and Bob Russell's CoCo memory map. And, if you haven't discovered our *Rainbow* installment plan, here's a money-saving idea: subscribe now to *the Rainbow* for just $22, and you'll receive 12 monthly installments of the CoCo's most versatile peripheral.

—Jim Reed

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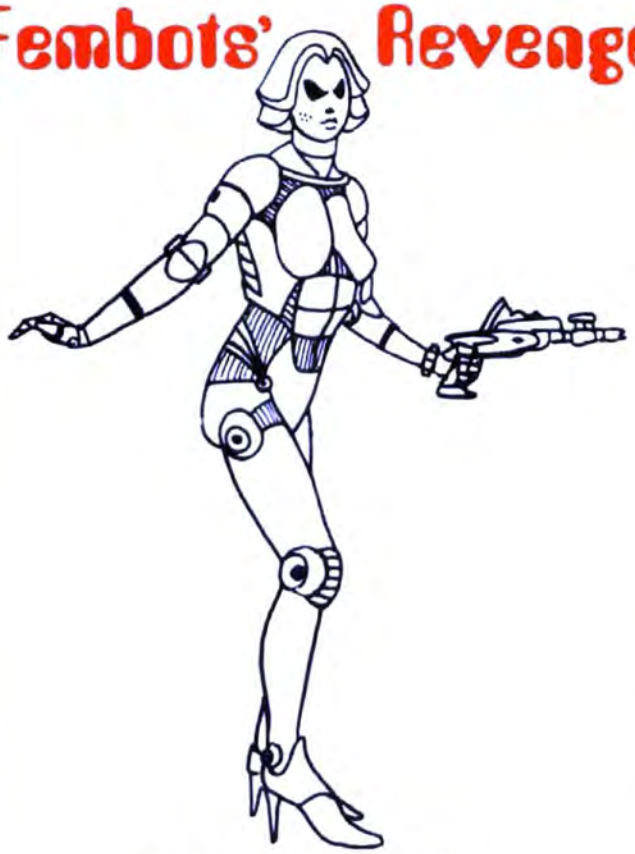
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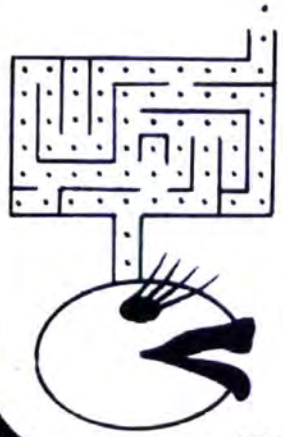


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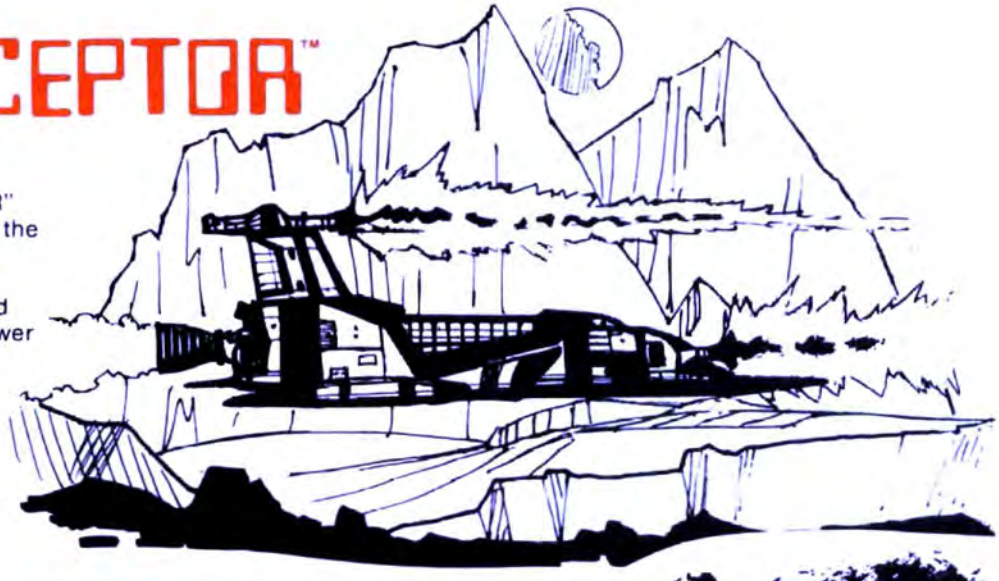
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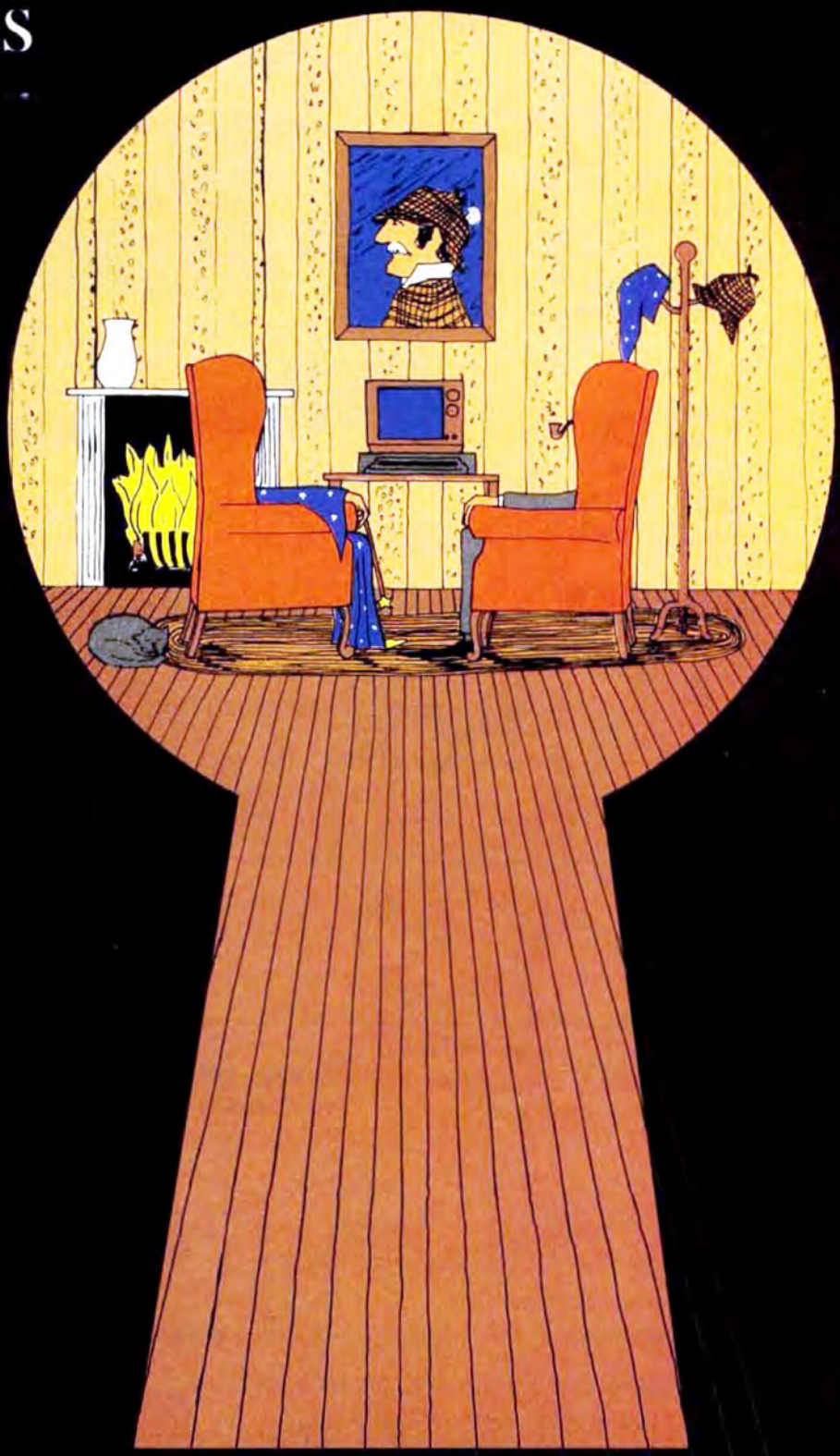
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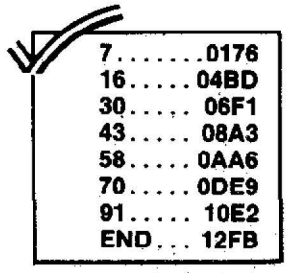
By Bob Delbourgo



Versions of the *Mastermind* game abound. This one, I think, is different, more versatile and more challenging. It can be played with color/number characters or with letters, which may be repeated any number of times in the hidden combination (as clearly happens in some words). Any number of persons can play. You can play solo in *Numbermind*, but *Lettermind* requires at least two players, because only true words are concealed and a dictionary has not been included in the program. Scoring is 10 points for every character correctly found and positioned; 2 points for every character correctly found but not correctly positioned, and -1 point for every guess after the first. Up to 15 guesses are permitted. Of course, scores are updated after each round.

I have restricted the number of hidden characters (N) to a maximum of eight, as there is simply no room on your video screen to display any more than 8 x 15 guesses, although in principle the analysis (lines 34 to 40, and 84 to 90) extends to any number of characters. Scoring is such that novices to the game can, without grave penalty, start with a small number of hidden characters, (two or three for example) and build up to larger values as they develop their mental reflexes. Expert players are invited to risk more by attempting larger values (six or more). Even they will find eight hidden characters hard to crack in 15 tries!

All set? Thinking caps on . . .



The listing:

```
1 CLS0:POKE359,13:SCREEN0,1:FORI
=1024TO1534STEP2:R=RND(26):S=RND
(8):POKEI,R:POKEI+1,127+16*S:NEX
TI
2 PRINT@235,"MASTERMIND";:PRINT@
427,"r.delbourgo";:PRINT@456,"15
,willowdene av.";:PRINT@481,"hob
art,tasmania, australia7005";:PL
AY"L30V30O1C02C03C04C05C04C03C02
C01C02C03C04C05C04C03C02C01CP1"
3 CLS0:PRINT@169,"LETTERMIND (L)
";:PRINT@238,"OR";:PRINT@297,"NU
MBERMIND (N)";
4 I$=INKEY$:IFI$=""THEN4
5 IFI$="N"THEN8
6 IFI$="L"THEN59
7 GOTO4
8 CLS:PRINT"  --NUMBERMIND INSTR
UCTIONS--":PRINT
9 PRINT"THIS COMPUTER VERSION OF
 THE    POPULAR GAME USES THE TR
S-80C   GRAPHIC CHARACTERS."
10 PRINT"THERE ARE 8 DIFFERENT H
IDDEN    COLOURS AND YOU CAN CHO
OSE YOUR LEVEL OF DIFFICULTY BY
HAVING UPTO 8 HIDDEN CHARACTERS.
"
11 PRINT"YOUR GUESSES ARE ENTERE
D AS     COLUMNS. AFTER TYPING I
N NUMBERSACCORDING TO A COLOUR C
ODE, THE COMPUTER ASSESSES YOUR
GUESS:"
12 PRINT"R=# CHARACTERS RIGHTLY
PLACED":PRINT"W=# CHARACTERS WRO
NGLY PLACED":PRINT"T=# GUESSES
                    ";
13 FORX=1TO5000:NEXTX
14 PRINT" ANY NUMBER CAN PLAY AN
D EACH    PLAYER HAS UP TO 15 GU
ESSES.":PRINT"SCORING IS 10*R+2*
W-T+1":PRINT"NOTE THAT CHARACTER
S MAY WELL BEREPEATED!":PRINT:PR
INT"GOOD LUCK AND GOOD THINKING!
":PRINT:FORX=1TO5000:NEXTX
15 CLS0:INPUT"ENTER NUMBER OF PL
AYERS";P:DIMS(P):DIMN(P):DIMP$(P
):DIMA$(P):DIMA(8,P):DIMB(8,P):D
IMC(8,P)
16 FORJ=1TOP:PRINT"PLAYER #"J",
YOUR NAME";:INPUTP$(J):NEXTJ
17 FORJ=1TOP:FORI=1TO8:A(I,J)=0:
B(I,J)=0:C(I,J)=0:NEXTI,J
18 FORJ=1TOP
19 CLS0:PRINTP$(J);", HOW MANY C
HARACTERS?          (MAXIMUM OF 8
)";:INPUTN(J):N(J)=INT(N(J)):IF
N(J)>8ORN(J)<1THEN19
20 T=0:R=0:W=0
21 FORI=1TON(J):R=RND(8):B(I,J)=
R:C(I,J)=R:NEXTI
22 CLS0:PRINT@0,"T";:PRINT@32*(N
(J)+1),"R";:PRINT@32*(N(J)+2),"W
";:PRINT@416,"COLOUR CODE IS:";:
FORI=1TO8:PRINT@443+8*I,"=";I;:N
EXTI23 FORI=1TO8:PRINT@442+8*I,C
HR$(127+16*I);:NEXTI
24 T=T+1:IFT>15THEN47
25 FORI=1376TO1439:POKEI,128:NEX
TI:PRINT@352,P$(J);", YOUR GUESS
";:INPUTA$(J):IF LEN(A$(J))<>N(J
) THEN25
26 PRINT@384,"IS THAT CORRECT (Y
/N)?";
27 I$=INKEY$:IFI$=""THEN27
28 IFI$="N"THEN25
29 IFI$="Y"THEN31
30 GOTO26
31 FORI=1408TO1439:POKEI,128:NEX
TI:FORI=1TON(J):A(I,J)=VAL(MID$(
A$(J),I,1)):NEXTI
32 PRINT@2*T,HEX$(T);:FORI=1TON(
J):POKE1024+T*2+32*I,127+16*A(I,
J):NEXTI
33 R=0:W=0:FORI=1TON(J):C(I,J)=B
(I,J):NEXTI
34 FORI=1TON(J):IFA(I,J)=C(I,J)T
HENR=R+1:A(I,J)=0:C(I,J)=0
35 NEXTI
36 FORI=1TON(J):IFA(I,J)=0THEN40
37 FORK=I+1TOI+N(J)-1:L=K-N(J)*I
NT((K-1)/N(J))
38 IFA(I,J)=C(L,J) THEN W=W+1:A(
I,J)=0:C(L,J)=0:GOTO40
39 NEXTK
40 NEXTI
41 PRINT@32*(N(J)+1)-1+2*T,R;:PR
INT@32*(N(J)+2)-1+2*T,W;
42 IFR=N(J) THEN 44
43 GOTO24
44 FORH=1TO6:PLAY"O4L255T255V30A
BCDGEEADFCBFGEAD":NEXTH
45 CLS0:PRINT"WELL DONE!"
46 GOTO49
47 FORI=1376TO1439:POKEI,128:NEX
TI:PRINT@352,"YOU'VE BLOWN IT, "
;P$(J):PLAY"O1T255L255V30GFEDCGF
EDCGFEDCGFEDCDDDDDD":PRINT@384,"
HIDDEN SET IS ";:FORI=1TON(J):PO
KE1421+I,127+16*B(I,J):NEXTI
48 FORX=1TO5000:NEXTX:CLS0:PRINT
```

```
"TRY HARDER!"
49 S(J)=S(J)+10*R+2*W-T+1
50 PRINT:PRINTP$(J);", YOUR SCOR
E IS"S(J):FORX=1TO2000:NEXTX
51 NEXTJ
52 CLS0:PRINT@0,"
SCORES":PRINT
53 FORJ=1TOP:PRINTP$(J),S(J):NEX
TJ
54 PRINT@486,"ANOTHER ROUND?(Y/N
)";
55 I$=INKEY$:IFI$=""THEN55
56 IFI$="Y"THENGOTO17
57 IFI$="N"THENCLS0:END
58 GOTO55
59 CLS:PRINT"  -- LETTERMIND INS
TRUCTIONS--":PRINT
60 PRINT"THIS GAME REQUIRES TWO
PLAYERS  AT LEAST. EACH PLAYER H
AS UP TO 15 GUESSES TO FIND A HI
DDEN REALWORD (UP TO 8 LETTERS;
PLEASE   NO PLURALS) ENTERED SEC
RETLY BY ANOTHER PLAYER."
61 PRINT"GUESSES WILL BE ENTERED
 AS      COLUMNS AND THE COMPUTE
R WILL   ASSESS EACH GUESS AS FO
LLOWS:"
62 PRINT"R=# LETTERS RIGHTLY PLA
CED":PRINT"W=# LETTERS WRONGLY P
LACED":PRINT"T=# GUESSES"
63 PRINT"SCORING IS 10*R+2*W-T+1
":PRINT"GOOD LUCK AND GOOD THINK
ING!";
64 FORX=1TO5000:NEXTX
65 CLS0:INPUT"ENTER # OF PLAYERS
 (>1)";P1:DIMQ(P1):DIMM(P1):DIMP
1$(P1)
66 FORJ=1TOP1:PRINT"PLAYER #"J",
 YOUR NAME";:INPUTP1$(J):NEXTJ:D
IMB1$(8,P1):DIMA1$(8,P1):DIMC1$(
8,P1):DIME$(P1):DIMD$(P1)
67 FORJ=1TOP1:FORI=1TO8:A1$(I,J)
="":B1$(I,J)="":C1$(I,J)="":NEXT
I,J
68 FORJ=1TOP1:CLS0:PRINT"ENTER T
HE HIDDEN WORD (3 TO 8  LETTERS
 LONG) FOR ";P1$(J);:INPUTD$(J):
M(J)=LEN(D$(J))
69 IFM(J)>8 OR M(J)<3THEN68
70 NEXTJ
71 FORJ=1TOP1
72 T=0:R=0:W=0
73 CLS0:PRINT@0,"T";:PRINT@32*(M
(J)+1),"R";:PRINT@32*(M(J)+2),"W
";:PRINT@416,"HIDDEN WORD IS"M(J
)"LETTERS LONG"
74 FORI=1376TO1439:POKEI,128:NEX
TI:PRINT@352,P1$(J)", YOUR GUESS
";:INPUTE$(J):IFLEN(E$(J))<>M(J)
 THEN74
75 PRINT@384,"IS THAT CORRECT (Y
/N)?";
76 I$=INKEY$:IFI$=""THEN76
77 IFI$="N"THEN74
78 IFI$="Y"THEN80
79 GOTO76
80 FORI=1TOM(J):A1$(I,J)=MID$(E$
(J),I,1):B1$(I,J)=MID$(D$(J),I,1
):C1$(I,J)=B1$(I,J):NEXTI
81 IFT>15THEN98
82 PRINT@2*T+2,HEX$(T+1);:FORI=1
TOM(J):PRINT@T*2+2+32*I,A1$(I,J)
;:NEXTI
83 R=0:W=0:FORI=1TOM(J):C1$(I,J)
=B1$(I,J):NEXTI
84 FORI=1TOM(J):IFA1$(I,J)=C1$(I
,J)THENR=R+1:A1$(I,J)="":C1$(I,J
)=""
85 NEXTI
86 FORI=1TOM(J):IFA1$(I,J)=""THE
N90
87 FORK=I+1TOI+M(J)-1:L=K-M(J)*I
NT((K-1)/M(J))
88 IFA1$(I,J)=C1$(L,J)THENW=W+1:
A1$(I,J)="":C1$(L,J)="":GOTO90
89 NEXTK
90 NEXTI
91 PRINT@32*(M(J)+1)+1+2*T,R;:PR
INT@32*(M(J)+2)+1+2*T,W;
```


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```
92 IFR=M(J)THEN 95
93 T=T+1:IFT>14THEN98
94 GOTO74
95 FORH=1TO6:PLAY"O4L255T255V30A
BCDEEADEFCBGEAD":NEXTH
96 CLS0:PRINT"WELL DONE!"
97 GOTO99
98 FORI=1376TO1439:POKEI,128:NEX
TI:PRINT@352,"YOU'VE BLOWN IT, "
;P1$(J):PLAY"O1T255L255V30GFEDCG
FEDCGFEDCGFEDCDDDDDD":PRINT@384,
"THE HIDDEN WORD WAS ";D$(J);:FO
RX=1TO3000:NEXTX:CLS0:PRINT"TRY
HARDER!"
99 Q(J)=Q(J)+10*R+2*W-T+1
100 PRINT:PRINTP1$(J);", YOUR SC
ORE IS"Q(J):FORX=1TO2000:NEXTX
101 NEXTJ
102 CLS0:PRINT@0,"
SCORES":PRINT
103 FORJ=1TOP1:PRINTP1$(J),Q(J):
NEXTJ
104 PRINT@486,"ANOTHER ROUND?(Y/
N)";
105 I$=INKEY$:IFI$=""THEN105
106 IFI$="Y"THENGOTO67
107 IFI$="N"THEN CLS0:END
108 GOTO105
```


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Mathwar Offers Skill Drill Plus Game

No one is talking to me at home. My children think I'm cruel and selfish. I spend hours at my CoCo playing an elementary arithmetic tutor. Sounds crazy, huh? It all started when I received *Mathwar* by Harmonycs to review. After reading the very brief documentation, which adequately explains how the program is used, I *CLOADed* it. I had to choose the skill I wanted to work on; addition or subtraction and then a skill level. When the gameboard appeared, I couldn't believe my eyes! On the screen was one of my favorite games. Sometimes I find it on restaurant tables in the form of a triangle. The object is to eliminate pegs by jumping over them until only one is left on the board. There are many names for this type of game, but I know it as Hi-Q. In order to play *Mathwar*, you have to choose a move by selecting a fighter and the space for it to jump to and then correctly answer arithmetic questions that are given at a predetermined level of difficulty. There are four choices here. In levels one and three, the numbers being added or subtracted are not higher than 19. Levels two and four have numbers that go up to 99. Also, levels one and two require no borrowing or exchanging, whereas levels three and four do. Incorrect answers are key beeped, but no other negative feedback is given. When only one fighter is left or no more legal moves are possible, the screen clears and a "YOU WON!" message appears. A new screen then gives the percentage of correct answers to the math questions.

The publisher recommends, and I agree, that an older child or adult assist the younger child the first few times he plays. The game portion could be a little complicated at first. The program is written so that unnecessary keystrokes and difficult input methods are eliminated and the child will have no difficulty in handling it himself in a short time. The author purposely does not make any recommendations as to age or grade level because each child's individual abilities should always be kept in mind. I observed children aged eight to 12 playing and their reactions were very positive. I believe the math skill level is most appropriate for eight to 10 year olds. Interest is maintained because both the math questions and gameboard are different each time. As expected, the children definitely enjoyed the challenge of the game more than the math problems.

In my estimation, *Mathwar* is a terrific program for kids of all ages.

(Harmonycs, P.O. Box 1573, Salt Lake City, Utah, $11.95 tape)

—Stephanie Snyder

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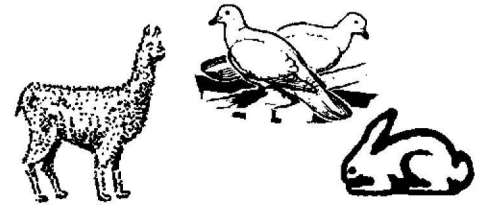
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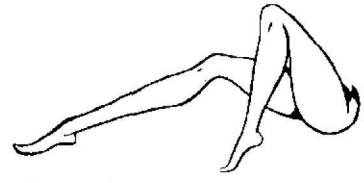


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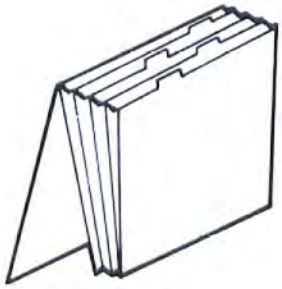
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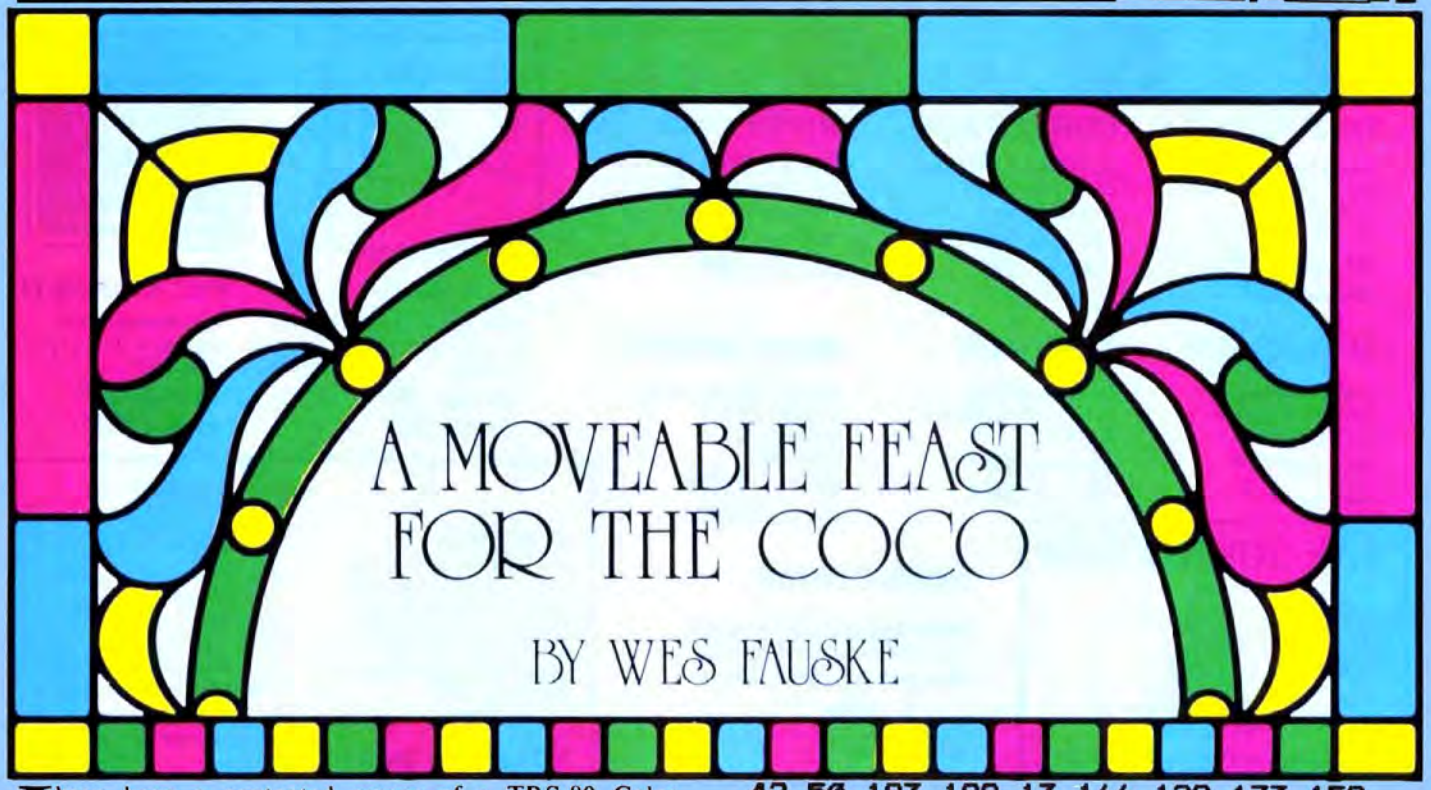
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A MOVEABLE FEAST FOR THE COCO

BY WES FAUSKE

I have been a contented owner of a TRS-80 Color Computer since June of 1981. Previously I owned a TRS-80 Model I and then an Apple II. In the Color Computer, I found the versatility I have been looking for. This program was written to demonstrate some of the untapped potential of the CoCo. The program uses the SG24 graphics mode which has a resolution of 64 x 192 in eight colors. This mode is supposed to use 6K of RAM, but *Stained Glass* uses only 3K of video RAM. Some of you might want to try to figure out why. The program creates continuously changing symmetrical patterns.

Type this program very carefully, being sure to save it to tape or disk before you attempt to run it. The slightest error could make you have to turn off the computer to regain control. Once safely saved type *RUN* and then *EXEC* 13015. Press any key to begin. Hit any key except BREAK to pause the display, and any key to continue. Press BREAK to return to BASIC. Now sit back and see why they call it a Color Computer.

Stained Glass can be saved as machine code by typing SCAVEM "STNDGLAS",12993,13311,13015. To load and use the program in this form, type *CLOADM* and then *EXEC* 13015. It's compatible with all versions of BASIC and 16K or 32K.

The listing:

```
1 '       STAINED GLASS
2 '            BY
3 '        WES FAUSKE
10 CLEAR200,12992
15 FORM=12993TO13311
20 READD:POKEM,D:NEXTM
25 DATA80,82,69,83,83,32,65,78,8
9,32,75,69,89,128,140,64,0,38,24
9,142,50,142,142,52,0,134,128
30 DATA167,128,140,64,0,38,249,1
42,50,193,198,13,166,128,173,159
,160,2,90,38,247,141,67,39,252
35 DATA134,1,198,3,142,255,192,1
41,30,134,26,198,7,141,24,134,3,
183,50,214,182,1,22,141,29,129,0
40 DATA39,45,134,128,183,50,206,
183,50,207,32,59,70,36,6,48,1,16
7,128,32,2,167,129,90,38,242,57
45 DATA177,50,214,37,5,176,50,21
4,32,246,57,173,159,170,49,173,1
59,160,0,57,134,8,183,50,214,182
50 DATA1,23,141,226,76,198,16,61
,203,122,247,50,206,192,5,247,50
,207,134,16,183,50,214,182,1,24
55 DATA141,202,129,1,35,8,183,50
,214,182,1,24,141,190,183,50,208
,134,15,176,50,208,183,50,209
60 DATA134,48,183,50,214,182,1,2
5,141,169,129,1,35,8,183,50,214,
182,1,25,141,157,72,183,50,210
65 DATA134,94,176,50,210,198,16,
61,253,50,212,182,50,210,198,16,
61,253,50,210,141,142,39,8,129,3
70 DATA39,81,141,134,39,252,190,
50,210,48,137,52,0,246,50,208,18
2,50,206,167,133,246,50,209,182
75 DATA50,207,167,133,190,50,212
,48,137,52,0,167,133,246,50,208,
182,50,206,167,133,190,50,210,48
80 DATA137,58,0,167,133,246,50,2
09,182,50,207,167,133,190,50,212
,48,137,58,0,167,133,246,50,208,
182,50,206,167,133,126,51,4,57
```

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A Mixed Bag Of BASIC

By Richard A. White
Rainbow Contributing Editor

Magazine deadlines being what they are, I am writing this well before the July issue goes into the mail. So, I have no idea what bugs will be found in *COMMWP* or what fixes and improvements you intrepid programmers will make. Yes, there are bugs. That was Version 1, not Version 3 or 4. And I am curious to see if you find the same bugs I have found. No, I did not put them there to mess you up and make you think. I *left* them there for that reason. Bugs come too easily for anyone to try to write them. Anyway, as you develop new pieces of code to fix or improve *COMMWP*, send a copy to my attention care of *the Rainbow*. On down the road I will pull together the better offerings into an article or two.

Another Bug in BASIC And Insanity Avoided

The staff at *the Rainbow* will be glad to know that we have saved them another drain on their taxes, specifically housing one Ian Budd in a Kentucky mental institution. Ian had the unfortunate experience of uncovering an erratic bug in the floating point decimal routine in CoCo. The following short program demonstrates the Budd Syndrome.

```
10 Y = 75.96 : X = 72 + 3.96 : PRINT X, Y
20 IF X=Y THEN PRINT "GOOD" ELSE PRINT "BAD"
```

Obviously, since 72 + 3.96 = 75.96 and the computer prints that result to the screen for X, it will also find X = Y and print GOOD. Wrong. The computer finds that X <> Y and prints BAD. But, change X and Y to Y = 75.75 : X = 72 + 3.95 and the program works properly.

Certain other combinations also return the wrong answer and Ian could find no pattern. He was trying to write a double entry bookkeeping program and erratic behavior like this was totally intolerable. He tried converting the numbers to integer values before making the comparison, but that did not work either. However, in CoCo BASIC there is no true 2-byte integer. Numbers are all stored in 5-byte format and a misplaced bit anywhere in that array will cause a faulty comparison even though the numbers printed on the screen look equal and integer. And there is a clue to the fix.

To display a number on the screen, the computer must convert it to character format. If we do this for X and Y and then make the comparison, the problem goes away. Try the program below and see for yourself.

```
10 Y = 75.96 : X = 72 + 3.96 : X$ = STR$(X)
   : Y$ = SRT$(Y) : PRINT X$, Y$
20 IF X$ = Y$ THEN PRINT "GOOD" ELSE PRINT
   "BAD"
```

> *"... weird things can happen if the test code after* IF *is faulty and ... a wrong result can be obtained without producing an error message."*

Each string consists of a leading space (CHR$(32)) and the ASCII values for each character in the number. There can be no effects from rounding or whatever was causing the error when comparing certain numeric variables.

Of course many of you are crying WHY?? Now that I have a fix, I have not gone looking for why, but you sure can. I would suggest writing a program including the above code to set values into X and Y. Then use *VARPTR* to report the locations of X and Y in the variable table. Remember to define any variables used in your *VARPTR* code or any variables that may follow it at the start of the program so the variables are not moved in the table. A simple R=0 puts R into the table and it will not cause trouble later. Now, if you have a resident monitor like in *Toolkit*, you can break the program and look at the five bytes stored for X and for Y. Perhaps as easy is to write a BASIC line to *PEEK* those locations and print the results to the screen. Put it in as a high line number using variables that have been defined or used in the program. *RUN* your program, *BREAK* it, and type *GOTO* (line number) to check the bytes in X and Y. If there is a difference, we will at least know the *IF* routine in BASIC is doing its job. That would leave the floating point routine at fault and decoding that is a job for a real expert.

***IF's* True-False Test**

I noted last month that weird things can happen if the test code after an *IF* is faulty and that a wrong result can be

(Richard White has a long background with microcomputers and specializes in BASIC programming. With Don Dollberg, he is the author of the TIMS data base management program.)

obtained without producing an error message. Basically the computer performs whatever is called for after the *IF* and looks for a result that tells it what to do next. If it gets a "0" it reads the test as false and does not do the code following the *THEN*. If an *ELSE* is present it goes to the code following it. If it gets any number back, it interprets the test to be true and goes to the code following the *THEN*. You can test this out using the following short program.

```
10 INPUT "DEMO =";DEMO: IF DEMO THEN PRINT
   "TRUE": GOTO 10
   ELSE PRINT "FALSE": GOTO10
```

Here is a typical keyboard session.

```
DEMO =? 0
FALSE
DEMO =? 1
TRUE
DEMO =? 2
TRUE
DEMO =? -1
TRUE
DEMO =? A
?REDO
```

That is because *INPUT* is looking for numbers only.

Note that the variable DEMO alone was used after *IF*. *IF* is looking for a number and a variable is as good a place as any to get anumber. Just pressing the *ENTER* key without entering anything puts a 0 into the variable so that works. The following does not work and produces a syntax error.

```
10 INPUT "DEMO$ =";DEMO$ : IF DEMO$ THEN
   PRINT "TRUE": GOTO 10
   ELSE PRINT "FALSE": GOTO10
```

The *IF* routine in BASIC cannot convert a string variable to a number so it quits. The following makes a test that prints FALSE if DEMO$ is nothing.

```
10 INPUT "DEMO$ =";DEMO$ : IF DEMO$<>""
   THEN PRINT "TRUE": GOTO 10
   ELSE PRINT "FALSE": GOTO10
```

Get That Arrow Again

Jerel Williams of Cincinnati brought my attention to something I had partly understood and forgotten. His son Bryce wrote a simple maze game for his younger sister. Really an excellent effort for an 11 year old. However, an arrow key had to be hit each time to move through the maze. An auto repeat, so one could hold down a key and continue moving, was called for. How could this be done from BASIC? It turns out there is a "keyboard rollover table" in memory locations 338 to 345 (hex 152-159). As long as there are no keys pressed, each location holds a 255. When a key is pressed, the value in the location assigned to that key is reduced by a specified amount. For example, the up arrow puts a 247 in 341. Even better, down arrow puts a 247 in 342, left puts 247 in 343 and right puts 247 in 344. From here it was simple to *PEEK* these locations in order, check each value returned and go off to the appropriate routine to move when a 247 is seen.

I could present Jerel's table of values. Rather I will present the following short program to allow you to investigate these locations on your own.

```
5 CLS : PRINT @64, "";
10 FOR X=338 TO 345 :PRINT X" "PEEK(X) : NEXT
   :PRINT @64, "";
   : GOTO 10
```


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When you run this, you get a listing of the memory location numbers followed by the value in that location. Press individual keys and see the numbers change on the screen. When two or more keys are pressed at the same time, either values in two or more locations change or if two keys are reported by one memory location, that location is reduced more than that caused by either key singly. Press a "9" and note that 223 appears in 339. This is 255 minus 32. *CLEAR* key subtracts 64 from 255 and puts 191 into 339. If *CLEAR* and 9 are pressed at the same time, 64 and 32 are subtracted from 255 and the result in 339 is 159. Thus it is possible to determine which keys are pressed at any time.

You can use this from BASIC to get responses requiring two keys to be pressed at the same time. The advantage is elimination of accidental responses in a program. Escape sequences are a natural where a two-key entry assures that is what the user wants and not a random call by five-year-old hands roaming the keyboard. Suppose you did choose CLEAR-9 as your escape. The following line would do the job:

```
155 P = PEEK(339) : IF P = 159 THEN 1000
```

Location 339 holds 159 as long as the CLEAR and 9 keys are pressed so all the user needs do is hold those keys down and wait for the program to execute line 155.

Merging BASIC Programs

There are a number of reasons for wanting to merge BASIC programs or perhaps parts of BASIC programs. John Reid of Woodside, New York, wrote that he wanted to merge a number of short programs into one large program and select the smaller programs from a menu. Another reason might be so that a routine used in one program could be reused with perhaps modest modification in another. Those with R.S. disk drives have the Disk BASIC *MERGE* command. This command runs a BASIC program saved in ASCII in from the disk through BASIC's tokenizing routine much as if the stream of characters were coming from the keyboard. BASIC tokenized the lines and inserts them into the program. Where there are existing lines in the program with the same numbers as those in the disk program, the lines from the disk are substituted. Otherwise the new lines from disk are inserted in the program in their correct numerical order.

Those not yet blessed or cursed with a disk drive have a number of other options. Both *EDTASM+* from Radio Shack and *Toolkit* from Azirin permit loading two files and merging them as one program. Other programming utilities may provide similar abilities. I have used only those mentioned. With *EDTASM+*, the programs must be saved as ASCII files. They are then loaded into the editor in sequence. All the line numbers of the second program must be higher than those in the first program. While you can renumber lines with *EDTASM+*, line numbers following *THEN*, *GOTO*, and *GOSUB* commands are not corrected as they are when BASIC *RENUM* is used. You would need to figure these out and change lines by hand which on any program of more than 10 lines would be a horror. Use BASIC's *RENUM* command, *CSAVE* the program and then *CLOAD* it back in as the send program during the merge operation. The combined file could then be saved and loaded into the computer as one program.

In *Toolkit*, there is a .PROT command that sets the Start of BASIC pointers (memory locations 25 and 26) to the end of the existing program. A new program can then be loaded. Again, line numbers of the second program need to be all higher than those of the protected program. In this case, the second program can be renumbered with Extended BASIC's *RENUM* after it is loaded. The merge is achieved by sending *Toolkit* a .REST command.

"Escape sequences are a natural where a two-key entry assures that is what the user wants and not a random call by five-year-old hands roaming the keyboard."

If you have Extended BASIC but none of the utilities mentioned, you can stick the following two lines of code in the first program loaded.

```
50 CLS :PH=PEEK(27) :PL=PEEK(28) :PRINT @96,
"LOAD RECORDER WITH PROGRAM TO BE
  MERGED AND PRESS ANY KEY" :FORX=0TO0
  :X=(INKEY$="") :NEXT
  :PRINT@96,"ENTER FILE NAME OF PROGRAM
  TO BEMERGED":LINEINPUTNA$
51 PRINT"TO MERGE PROGRAMS AFTER
  "NA$" IS LOADED, POKE25,30
  AND      POKE26,1" :POKE25,PH :POKE26,PL-2
  :CLOADNA$:END
```

This fragment expects you to be in default *PCLEAR 4*. The End of BASIC address is obtained from memory locations 27 and 28. Once the tape with the second program is in the recorder and its name entered, the end of the first program is made the Start of BASIC for the new program by *POKEing* PH into 25 and PL-2 into 26. Then the second program is loaded. You restore the first program and effect the merge by *POKEing* the original Start of BASIC pointers, 30 and 1 back into 25 and 26. Note that PL-2 was set rather than PL in the start addressed for the second program. BASIC puts three null (0) bytes at the end of a program and one null at the end of each line. The End of BASIC address in 28 is one byte after the third null byte. Since we are going to merge the programs we want only one null after the last line of the first program. By subtracting two from PL, we load the first two bytes of the second program over the last two nulls at the end of the first.

In some instances, you will want to *PCLEAR* less than four graphics pages to get more program and variable memory. This changes the value in 25 by 6 for each page of graphics given up. In fact, you can do a *PCEAR 0* by typing POKE25, 6 :NEW before loading a program. You may wish to change the fragment above to *PEEK* Start of BASIC before changing it and print these values on the screen for your reference later.

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Racing The Clock With TRAILIN' TAIL!

By Mike Hall



It is the year 2013. The earth has just been devastated by war. You are the last remaining human, and your only chance of survival is to leave the earth as soon as possible. Fortunately, you have found a spaceship that was left over from the war. Unfortunately, it doesn't have enough energy left to fly!

Your mission: Roam the earth in your nuclear powered land cruiser and gather yellow and blue power chips for the spaceship in as little time as possible. But watch out! If you cruise out of the safe zone or run into the nuclear waste that is left behind by your land cruiser, you will immediately perish!

Does the above scenario sound exciting? Well, then, you're in luck, because it's the scenario for the game below called *Trailin' Tail*. It is a progressively faster and harder, race-against-the-clock, arcade style game. *Trailin' Tail* requires 32K Extended BASIC and one joystick.

After *CLOADing* and *RUNning* the program, you will be presented with the title page and asked whether to play with the keyboard controls or with the joystick. (If you have disk, this is the

(Mike Hall is a high school junior in Hartland, Wisconsin. He is a self-taught programmer who actively participates in the Milwaukee Area Color Computer Users' Group, the CoCo-MUGS.)

point at which the scores will be read in. See the disk user's note below.) The keyboard controls are just the four arrow keys. If you choose the joystick option, use the right one. You will note, once you have played both ways, that *Trailin' Tail* is really two games in one. The keyboard game only allows for movement in four directions, whereas the joystick game allows for movement in eight directions. After choosing your controls, you will be asked which wave to start on. The higher the wave, the faster (and more difficult) it is. Once the wave is chosen, you will be presented with the starting game board. The red border denotes the "safe zone," so don't run into the walls! Your status is designated above the border. At the far left, in blue, is the score. In the middle, in yellow, is the wave number. To the right of that, in blue, is the number of land cruisers remaining. And at the far right, in red, is the number of power chips you have to collect before advancing to the next wave.

To start the game, just follow the directions on the lower right of the screen. If you are using the joystick, it must be pointing in some direction at all times, othewise you will crash into yourself. Once started, the object of the game is to hit the yellow and blue squares and avoid anything that is red. It sounds simple enough, but once you get going you will find that more and more red appears. You should also discover how the name *Trailin' Tail* came about. Beware of the part of the tail that doesn't erase itself! If you do crash into any red object, you will lose a land cruiser and five seconds of time. The game ends when all of your land cruisers are gone.

Scoring for *Trailin' Tail* is pretty complex. The yellow power chips are worth from 20 to 200 points in multiples of 20. The blue power chips are worth from 50 to 500 points in multiples of 50. When you finish a wave, your time will be compared to the predetermined average time for that wave. If you beat it, two things happen. First, you are given a bonus of five times the wave number, times the number of seconds you beat the average by. Then you are given a special bonus, which counts the same amount of points as the last power chip. Therefore, it is best to finish a wave with a blue power chip rather than a yellow one, since blue ones are worth more. Also, if you started on a wave other than wave one, you will be given a super bonus of 1500 times the number of the wave you started on, minus one. The super bonus is only given after the first completed wave.

An extra land cruiser is awarded at 10,000 points, and then at every 5,000 points after that. But, you can only earn an extra land cruiser by hitting a power chip. So, for example, if you score 12,000 bonus points on one wave, you won't get your extra land cruiser until you hit a power chip on the next wave.

Wave nine is the fastest wave you will encounter. *Trailin' Tail* still gets more difficult on waves 10 and up, but instead of getting faster, obstacles start appearing and more power chips must be gathered in order to advance to the next wave. Obstacles appear in the form of large, red circles. They show up *after* you press the joystick button or an arrow key. Then, a slight delay occurs, allowing you to change your initial direction by pressing a different arrow key or by moving the joystick lever, and the game continues as usual.

One of *Trailin' Tail*'s best features is its top 10 score routine. If you have scored high enough to make the top 10, *Trailin' Tail* will notify you with an alarm (otherwise it will just start displaying the top 10 scores). Three large boxes will appear on the screen with a flashing letter in the left one. Just move the joystick lever up or down until you find the appropriate number or letter. Then, push the joystick button, and that initial will be entered. Repeat this process with the other two boxes. When all three initials have been entered, *Trailin' Tail* will remember those initials (and your score), and display them on the top 10 screen. While on the top 10 screen, you have two options: either you can push the joystick button and start a new game, or you can push the E key and end the program. (If you have disk, the top 10 scores will be saved before the program ends. See the note below.)

Note for disk users: *Trailin' Tail* checks to see if you have disk. If you do, it will automatically keep a disk file of the top 10 high scores. But you must create this file prior to the very first time you run the program. To do so, just *ENTER* the following statement while in the OK mode: OPEN "O",#1,"TTSCORES/T10":CLOSE.

For those of you who like to modify programs, the remarks below have been left in, and a list of the main variables follows. (There are no references to the remark lines, so they can be deleted if you like.)

SC	score
W	wave
N	number of land cruisers remaining
T	timer
A	average time
E	points needed for next land cruiser
F	number of power chips remaining
S	skill level

Although it is made for 32K, I believe *Trailin' Tail* will fit in 16K if the following lines are changed to read as follows:

```
0     PCLEAR2:'16K VERSION
1050  PMODE2,1:PCLS:FORQW=1TO20:PRINTSTRING$
        (32,"!");:NEXTQW:SCREEN0,1
1060  DRAW"BM34,20;S8;C1":M$"CONGRATULATIONS":
        GOSUB1000
1070  DRAW"BM12,60":M$="TEN OF TRAILIN TAIL"
        :GOSUB1000
1080  PMODE2,1:DRAW"BM4,40":M$="YOU HAVE
        MADE THE TOP":GOSUB1000:SCREEN1,1:
        DRAW"S4"
1350  PMODE2,1:PCLS:SCREEN1,1
```

		900....	126F
60.....	0378	1060...	150A
180....	060C	1160...	17B7
310....	08D3	1360...	1A03
520....	0B19	1530...	1C16
600....	0DA3	1800...	1E5E
770....	102A	END....	2023

The listing:

```
0 PCLEAR4:'32K VERSION
1 '************************
2 '***** TRAILIN TAIL *****
3 '***** BY MIKE HALL *****
4 '**3019 SYLVESTER DRIVE**
5 '***HARTLAND, WI 53029***
6 '************************
7 'COMPLETED MARCH 3, 1983*
8 '************************
9 'set screen and variables
```

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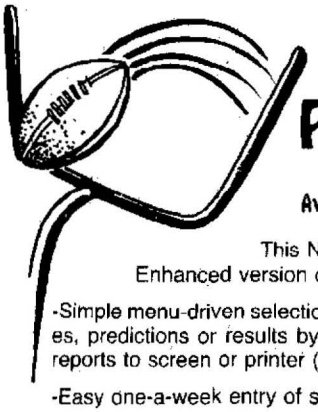
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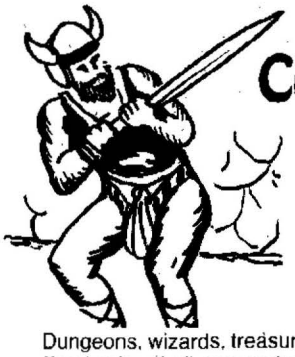
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4),B(4),E(10),S(11),S$(11),G(50)
:FORZ=1TO43:READCH$(Z):PLAY"L255
;ABA":NEXT:FORZ=1TO10:S(Z)=0:S$(
Z)="    ":NEXT
20 PMODE1,1:PCLS:SCREEN1,0:DRAW"
BM30,24;C3;S8":M$="TRAILIN TAIL"
:GOSUB1000
30 DRAW"BM100,180;C4":M$="BY":GO
SUB1000:GET(100,164)-(125,190),G
,G:FORY=164TO30STEP-4:PLAY"O3CB"
:PUT(100,Y)-(125,Y+20),G,PSET:NE
XT
40 DRAW"BM60,70;C3":M$="MIKE HAL
L":GOSUB1000:DRAW"BM62,72;C2":GO
SUB1000
45 GOSUB2000
50 DRAW"BM10,100;C2":M$="CHOOSE
1 OR 2":GOSUB1000:DRAW"BM10,120;
C3":M$="1 IS KEYBOARD":GOSUB1000
:DRAW"BM10,140":M$="2 IS JOYSTIC
K":GOSUB1000
60 V=RND(191):C=RND(4):DRAW"C"+S
TR$(C):LINE(180,V)-(255,191-V),P
SET:A$=INKEY$:IFA$=""THEN60ELSEI
FA$="1"THENKY=1ELSEIFA$="2"THENK
Y=0ELSE60
70 PCLS:DRAW"BM10,140;C4":M$="WH
ICH WAVE WOULD YOU":GOSUB1000:DR
AW"BM10,160":M$="LIKE TO START O
N":GOSUB1000:DRAW"BM70,180;C3":M
$="1 TO 9":GOSUB1000
80 H=RND(255):V=RND(120):C=RND(4
):DRAW"C"+STR$(C):LINE(H,V)-(255
-H,V),PSET:A$=INKEY$:IFA$=""THEN
80
90 W=VAL(A$):IFW<1ORW>9THEN70
100 PMODE1,1:PCLS:SCREEN1,0:SB=(
W-1)*1500:SC=0
110 E=10000:F=15:T=0:N=4:M$=STR$
(SC):DRAW"BM0,12;C3S8":GOSUB1000
120 M$=STR$(N+1):DRAW"BM170,12;C
3":GOSUB1000:M$=STR$(F):DRAW"BM2
10,12;C4":GOSUB1000
149 'start of wave
150 M$="WAVE":DRAW"BM90,12;C2S8"
:GOSUB1000:M$=STR$(W-1):DRAW"BM1
32,12;C1":GOSUB1000:M$=STR$(W):D
RAW"BM132,12;C2":GOSUB1000
160 DRAW"C1":LINE(10,24)-(245,18
1),PSET,BF:DRAW"C2"
170 GOSUB650:Z=1:GOSUB690:GOSUB6
60:Z=2:GOSUB690:GOSUB670:Z=3:GOS
UB690:PSET(128,96,4)
180 A(4)=0:X=128:Y=96:C=0:S=W+1:
IFS>10THENS=10
190 DRAW"C4":FORZ=0TO9:LINE(Z,Z+
14)-(255-Z,191-Z),PSET,B:NEXT
200 IFKY=1THENM$="PRESS AN":DRAW
"BM140,130;C2S8":GOSUB1000:M$="A
RROW":DRAW"BM156,150":GOSUB1000:
M$="KEY":DRAW"BM166,170":GOSUB10
00:A$=INKEY$:GOTO220
210 M$="PRESS THE":DRAW"BM134,13
0;C2S8":GOSUB1000:M$="JOYSTICK":
DRAW"BM136,150":GOSUB1000:M$="BU
TTON":DRAW"BM146,170":GOSUB1000:
GOTO230
220 GOSUB270:A$=INKEY$:IFA$=""TH
EN220ELSE240
230 GOSUB270:PP=PEEK(65280):IFPP
=254ORPP=126THEN240ELSE230
240 DRAW"BM170,12;C1":M$=STR$(N+
1):GOSUB1000:DRAW"BM170,12;C3":M
$=STR$(N):GOSUB1000:DRAW"C1":LIN
E(134,118)-(245,181),PSET,BF
250 IFW>9THENFORQQ=5TOW/2:H=RND(
90)+75:V=RND(90)+50:CIRCLE(H,V),
13,4:PAINT(H,V),4,4:NEXT:FORQQ=1
TO999:NEXT:OD$=A$:A$=INKEY$:IFA$
=""THENA$=OD$
260 TIMER=T:IFKY=1THEN440ELSE300
270 CC=CC+1:IFCC>99THENCC=1:GOTO
290
280 RETURN
290 SCREEN1,1:FORZ=1TO9:NEXT:SCR
EEN1,0:RETURN
299 'main program
300 J=JOYSTK(0):K=JOYSTK(1)
310 PLAY"L255;O1;A"
```


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  - * compare the contents of RAM buffer against an EPROM
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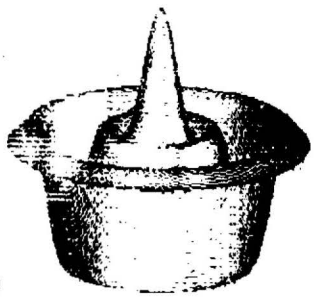
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```
320 IFKY=1THEN430
330 IFJ=0THENX=X-S
340 IFJ=63THENX=X+S
350 IFK=0THENY=Y-S
360 IFK=63THENY=Y+S
370 IFPPOINT(X,Y)<>1THEN700
380 C=C+1:IFC>99THEN900
390 X(C)=X:Y(C)=Y
400 IFC>197THENC=100
410 PSET(X,Y,4)
420 GOTO300
430 A$=INKEY$:IFA$=""THEN480
440 IFA$="^"THENYA=-S:XA=0
450 IFA$=CHR$(10)THENYA=S:XA=0
460 IFA$=CHR$(8)THENXA=-S:YA=0
470 IFA$=CHR$(9)THENXA=S:YA=0
480 X=X+XA:Y=Y+YA
490 GOTO370
499 'end of wave
500 T=TIMER:FORZ=1TO5:PLAY"L640"
+STR$(Z)+";1;2;3;3;4;5;6;6;7;8;9
;9;10;11;12;12":NEXT
510 F=15:T=INT(T/60):DRAW"C1":LI
NE(10,24)-(245,181),PSET,BF:IFW>
9THENF=W-9+F
520 M$="TIME TO COMPLETE":DRAW"B
M20,40;C2":GOSUB1000:M$="WAVE "+
STR$(W):DRAW"BM30,60":GOSUB1000:
M$=STR$(T):DRAW"BM180,60":GOSUB1
000
530 AA=(15-W)*10:IFAA<100THENAA=
100
540 M$="AVERAGE TIME":DRAW"BM20,
80;C4":GOSUB1000:M$=STR$(AA):DRA
W"BM180,80":GOSUB1000
550 T=AA-T:IFT<1THEN580
560 M$="BONUS X"+STR$(W*5):DRAW"
BM20,110;C3":GOSUB1000:FORD=1TOT
:DRAW"BM180,110;C3":M$=STR$(D*(W
*5)):GOSUB1000:DRAW"BM180,110;C1
":PLAY"L2001;ABA":GOSUB1000:NEX
T:DRAW"BM180,110;C3":GOSUB1000
570 M$="SPECIAL BONUS":DRAW"BM20
,150;C2":GOSUB1000:DRAW"BM21,149
":GOSUB1000:M$=STR$(P):DRAW"BM18
0,150":GOSUB1000:P=T*(5*W)+P:FOR
D=1TO1999:NEXT:GOSUB1020:GOTO590
580 M$="NO BONUS":DRAW"BM20,110;
C3":GOSUB1000:FORZ=1TO999:NEXT:G
OSUB1020
590 IFSB>1THENDRAW"BM20,180;C4":
M$="SUPER BONUS":GOSUB1000:P=SB:
SB=0:M$=STR$(P):DRAW"BM170,180":
GOSUB1000:GOSUB1020:FORZZ=1TO4:D
RAW"BM20,180;C"+STR$(ZZ):M$="SUP
ER BONUS":GOSUB1000:NEXTZZ:FORZ=
1TO999:NEXTZ
600 W=W+1:T=0:GOTO150
649 'pick coordinates of boxes
650 A(1)=RND(105)+130:B(1)=RND(6
0)+24:RETURN
660 A(2)=RND(105)+10:B(2)=RND(60
)+24:RETURN
670 A(3)=RND(105)+10:B(3)=RND(72
)+98:RETURN
680 A(4)=RND(105)+130:B(4)=RND(7
2)+98:RETURN
690 LINE(A(Z),B(Z))-(A(Z)+10,B(Z
)+10),PSET,BF:RETURN
699 'score or crash
700 IFPPOINT(X,Y)=4THEN850
710 IFPPOINT(X,Y)=3THEN730
720 P=RND(10)*20:GOTO740
730 P=RND(10)*50
740 PLAY"L255;V31;O3;ADEBCDGGFFA
ACDFBEDEBCD;V15;BCGGDFEGDFACABAC
DBDGE;V6;ABBCDACFDEGDFFEBGGA;V15
"
750 F=F-1:GOSUB1020:IFSC=>E THEN
E=E+5000:PLAY"T7L402;10;O3;3;7;L
2;10;L4;7;L2.;10;T2":DRAW"BM170,
12;C1":M$=STR$(N):GOSUB1000:DRAW
"BM170,12;C3":N=N+1:M$=STR$(N):G
OSUB1000
760 IFF=0THEN500
770 IFX>128ANDY<=96THENQ=1ELSEIF
X>128ANDY>96THENQ=4ELSEIFX<=128A
NDY<=96THENQ=2ELSEIFX<=128ANDY>9
6THENQ=3
```


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```
780 DRAW"C1":LINE(A(Q),B(Q))-(A(
Q)+10,B(Q)+10),PSET,BF
790 GET(A(Q),B(Q))-(A(Q)+35,B(Q)
+16),E,G:DRAW"BM"+STR$(A(Q)-8)+"
,"+STR$(B(Q)+12)+"S8C3":M$=STR$(
P):GOSUB1000:FORZ=1TO199:NEXT:PU
T(A(Q),B(Q))-(A(Q)+35,B(Q)+16),E
,PSET
800 FORZ=1TO4:IFA(Z)=0THENONZ GO
SUB650,660,670,680ELSENEXT
810 A(Q)=0:D=RND(2)+1:DRAW"C"+ST
R$(D):LINE(A(Z),B(Z))-(A(Z)+10,B
(Z)+10),PSET,BF
820 GOTO380
849 'crash
850 FORZ=1TO50:SCREEN1,1:SCREEN1
,0:NEXT:FORZ=1TO15STEP3:CIRCLE(X
,Y),Z,4:NEXT:N=N-1:PLAY"L9902;V5
;FFGEEFDD;V20;ECCDBBCAAB;O1V31;G
GFEEDFFECCDBBCDDCBAADGABBA;V6;AA
CBCDGEFAACBC;V15":FORCL=3TO1STEP
-1:FORZ=1TO15STEP3:CIRCLE(X,Y),Z
,CL:NEXTZ,CL
860 IFN=-1THEN950
870 T=TIMER
880 T=T+500:GOTO150
899 'erasing the trail
900 CC=C-99
910 IFPPOINT(X(CC),Y(CC))=4THEN9
30
920 Z=PPOINT(X(CC),Y(CC)):PSET(X
(CC),Y(CC),Z):GOTO940
930 Z=RND(50):IFZ>45THEN940ELSEP
SET(X(CC),Y(CC),1)
940 X(CC)=X:Y(CC)=Y:GOTO400
949 'end of game
950 PLAY"L255":FORO=3TO1STEP-1:C
=RND(3)+1:M$="GAME OVER":DRAW"BM
20,100;S16;C"+STR$(C):GOSUB1000:
FORZ=12TO1STEP-1:FORD=1TO3:PLAY"
O"+STR$(O)+";"+STR$(Z):NEXTD,Z,O
960 FORZ=1TO999:NEXT
970 IFSC>S(10)THEN1050ELSE1350
999 'drawing routine
1000 L=LEN(M$):FORZ=1TOL:M=ASC(M
ID$(M$,Z,1))-47:IFM=-15THENDRAW"
BR4"ELSEDRAWCH$(M)
1010 DRAW"BR2":NEXT:RETURN
1020 M$=STR$(SC):DRAW"BM0,12;C1S
8":GOSUB1000:SC=SC+P:M$=STR$(SC)
:DRAW"BM0,12;C3S8":GOSUB1000:DRA
W"C1":LINE(208,0)-(255,12),PSET,
BF:DRAW"BM210,12;C4":M$=STR$(F):
GOSUB1000:RETURN
1049 'get score
1050 PMODE3,1:PCLS:FORQW=1TO20:P
RINTSTRING$(32,"!");:NEXTQW:SCRE
EN0,1
1060 DRAW"BM14,20;S10;C2":M$="CO
NGRATULATIONS":GOSUB1000
1070 DRAW"BM32,60;C3":M$="TRAILI
N TAIL":GOSUB1000
1080 PMODE4,1:DRAW"BM36,35;C1;S4
":M$="YOU HAVE MADE THE TOP TEN
OF":GOSUB1000:SCREEN1,1
1090 PLAY"T128L104;12;11;10;9;8;
7;6;5;4;3;2;1;02;12;11;10;9;8;7;
6;5;4;3;2;1;01;12;11;10;9;8;7;6;
5;4;3;2;1;T168;04;12;8;4;12;8;4;
12;8;4;12;8;4;12;8;4;12;8;4;12;8
;4;12;8;4;12;8;4;12;8;4;12;8;4;1
2;8;4;12;8;4;12;8;4;T2"
1100 SCREEN1,0:DRAW"BM2,80"
1110 M$="ENTER YOUR INITIALS BY
MOVING THE JOYSTICK":GOSUB1000
1120 DRAW"BM2,90":M$="UP AND DOW
N TO CHANGE THE LETTERS":GOSUB10
00
1130 DRAW"BM2,176":M$="PUSH THE
JOYSTICK BUTTON WHEN YOU HAVE TH
E":GOSUB1000
1140 DRAW"BM2,186":M$="CORRECT I
NITIAL":GOSUB1000
1150 LINE(30,100)-(80,160),PSET,
B:LINE(90,100)-(140,160),PSET,B:
LINE(150,100)-(200,160),PSET,B
1160 DRAW"S24":D=65:X=40:A$="":Y
=1
1170 FORQQ=1TO9:NEXT:DRAW"BM"+ST
R$(X)+",150":IFD<48THEND=90
1180 IFD>90THEND=48
1190 M$=CHR$(D):DRAW"C1":GOSUB10
00
1200 J=JOYSTK(0):J=JOYSTK(1):IFJ
=0ORJ=63THENDRAW"BM"+STR$(X)+",1
50;C0":M$=CHR$(D):GOSUB1000:GOTO
1230
1210 DRAW"BM"+STR$(X)+",150;C0":
M$=CHR$(D):GOSUB1000
1220 PP=PEEK(65280):IFPP=126ORPP
=254THEN1250ELSE1170
1230 IFJ=0THEND=D+1:GOTO1170
1240 IFJ=63THEND=D-1:GOTO1170
1250 DRAW"BM"+STR$(X)+",150;C1":
M$=CHR$(D):GOSUB1000:A$=A$+M$:Y=
Y+1:IFY=4THEN1280
1260 X=X+60
1270 GOTO1170
1280 FORD=1TO10:IFSC>S(D)THEN129
0ELSENEXT
1290 FORC=10TODSTEP-1:S(C+1)=S(C
):S$(C+1)=S$(C):NEXT
1300 S(D)=SC:S$(D)=A$
1349 'display high scores
1350 PMODE4,1:PCLS:SCREEN1,1
1360 LINE(0,0)-(255,20),PSET,BF:
DRAW"BM12,16;C0;S8":M$="TRAILIN
TAIL TOP 10":GOSUB1000
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Quote from the March 1983 80 MICRO review by Scott Norman, pg. 101.
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LOOK AT THESE FEATURES
ED

ED is both line and screen oriented. This means that you can edit by line number or by using screen type editing where you move the cursor to where you wish to edit and then make your changes. The line editing mode is very handy for programming as most assemblers and compilers refer to line numbers when an error occurs, thus making it easy to correct if the editor like ED can go to a line number to edit. Once there, ED can switch to screen editing to make the corrections.

ED also has cut and paste type of editing, where you can split a line and move the other half. You can also delete and rename files on disk from ED, edit more than one file without leaving ED, and many more. Here is a list of features:

Menu will list the command set for ED
Set allows changing editor characters
Cursor allows changing cursor control strings
X sends out a user defined string
Status list flags and other internal editor settings
Head allows setting and listing of headers and tabs
Tab allows setting tab stops
Width set screen width
Number toggle number flag
Renumber renumbers the lines
Verify toggle the verify flag
Zone set or reset the zone flag for string searches
Top go to the top of the text (also works)
Bottom go to the bottom of the text (! also works)
Next target line becomes the current line
Find finds target string
Append appends a string to the current line
Change changes this to that in the text
CChange like above but asks you first
Copy copy a block a text
Cut cut the current line at a specified column
Delete a line or block of lines
Expand tabs in the text
Insert insert after the current line
Move move a block of text
Overlay the line
Print a line or block of lines
Replace a line or lines
Splice a line to the current line
Stop save the text to disk and edit
Abort exit the editor without changing anything
New allows working with files larger than available memory
Edit restart the editor with a new file
Dir list the directory of the disk
Read insert a file from disk into the file in memory
Write write a block of lines to a file on disk
Save save the file to disk
List list a line or group of lines
FEDL deletes a file on disk
FREN renames a file on disk
CMACRO create a macro
LMACRO list one or all macros
DMACRO delete a macro
MACRO execute a macro
CALCULATE performs math functions with results in binary, decimal, and hex
EXEC exec a text file as a set of commands for the editor
Bell rings the terminal bell (useful in macros)
REM used to document macros.

As you can see, ED is a very versatile and powerful editor for all your editing needs. It is particularly useful for the programmer that needs a flexible editor!!

LOOK AT THESE FEATURES
ASM

ASM is a fast and versatile (8 bit) macro assembler. It has the necessary elements to support structured constructs like WHILE and FOR etc. These are the ability to define macros with substitutable parameters, conditional assembly directives, and the ability to change the value of a label or symbol. In addition, source code may be assembled in modular form. That is as a series of LIBrary files. A short file containing a list of file specifications in standard assembler source format may call as many library files as desired. Symbols default to a maximum length of 6, but may be redefined to a maximum length of 3 to 30 characters.

ASM supports auto fielding and automatic label generation. Labels may be automatically generated and accessed within expressions.

This function has great power when used within macros. An example is the BASIC statement PRINT "HI". A macro would be created as:

```
An example would be:        PRINT MACRO          would expand into:
        BRA :1                      LDX #:1              PRINT "HI"
        FCC "HI",4                  JSR PSTRNG           LDX L0001
      : EQU *                       BRA :2               JSR PSTRNG
becomes:                          : FCC "&1",4           BRA L0002
        BRA L0001                 : EQU *          L0001 FCC "HI",4
        FCC "HI",4                  ENDM           L0002 EQU *
L0001   EQU *
```

ASM supports the following directives or pseudo operators.

FCC	form constant character(s)	**MACRO**	define a macro
FCS	form constant string	**ENDM**	end a macro definition
FCB	form constant byte	**EXITM**	exit macro being called
FDB	form double byte	**DUP**	duplicate lines n times up to 'ENDD'
SPC	insert spaces in the output listing	**ENDD**	end duplication bracket
LEN	set up length of output line for printing	**IF**	conditonal assembly control
OPT	switch assembler options	**ELSE**	complement true-false flag
PAG	skip to next page	**ENDIF**	end conditional assembly clause
ORG	define a new origin (*)	**ENDC**	end conditional assembly clause
RAM	define a new storage counter origin (.)	**WHILE**	incremental conditional assembly control
EQU, SET	(re-) assign a value to a symbol	**WELSE**	complement sense of WHILE test
END, MON	signal end of source code	**ENDW**	end WHILE clauses
NAM, TTL	specify a name or title	**LIB**	open a library source code file
STTL	specify a subtitle	**SYM**	define length of significant characters for symbols
RMB	reserve memory bytes		
ERR	print error message		
RPT	repeat following line n times		

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```
137Ø LINE(Ø,Ø)-(255,21),PSET,B:D
RAW"C1"
138Ø FORD=1TO1Ø:Y=D*16+2Ø:DRAW"B
M91,"+STR$(Y):M$=STR$(D):GOSUB1Ø
ØØ
139Ø DRAW"BM13Ø,"+STR$(Y):M$=S$(
D):GOSUB1ØØØ
14ØØ DRAW"BM171,"+STR$(Y):M$=STR
$(S(D)):GOSUB1ØØØ
141Ø NEXTD
142Ø FORX=ØTO9ØSTEP2:LINE(X,22)-
(X,191),PSET:NEXT:GOSUB148Ø
143Ø FORX=ØTO9ØSTEP2:LINE(X,22)-
(X,191),PRESET:NEXT:GOSUB148Ø
144Ø FORX=1TO89STEP2:LINE(X,22)-
(X,191),PSET:NEXT:GOSUB148Ø
145Ø FORX=1TO89STEP2:LINE(X,22)-
(X,191),PRESET:NEXT:GOSUB148Ø
146Ø IFG=1THENG=ØELSEG=1
147Ø SCREEN1,G:GOTO142Ø
148Ø PLAY"L32O1CO2CO3CO4CO5C"
149Ø PP=PEEK(65284):IFPP=126ORPP
=254THENPMODE1,1:PCLS:SCREEN1,Ø:
GOTO5Ø
1495 A$=INKEY$:IFA$="E"THEN3ØØØ
15ØØ RETURN
151Ø 'data for characters
152Ø DATABRHU4ERFD4GNLBR2
153Ø DATAR2U6NGD6R2
154Ø DATABU5ER2FDGL2GD2R4
155Ø DATABU5ER2FDGNLFDGL2NHBR3
156Ø DATABR3U6G3R4BD3
157Ø DATABUFR2EU2HL3U2R4BD6
158Ø DATABU3R3FDGL2HU4ER2BD6BR
159Ø DATABU6R4DG3D2BR3
16ØØ DATABRHUER2EUHL2GDFR2FDGNL2
BR
161Ø DATABRR2EU4HL2GDFR3BD3
162Ø DATABR4,BR4,BR4,BR4,BR4,BR4
,BR4
163Ø DATAU5ER2FD2NL4D3
164Ø DATARU6NLR2FDGNL2FDGNL3BR
165Ø DATABR4BU5HL2GD4FR2EBD
166Ø DATARU6NLR2FD4GNL2BR
167Ø DATAU6NR4D3NR3D3R4
168Ø DATAU3NR3U3R4BD6
169Ø DATABUU4ER3BD4NLD2L3NHR3
17ØØ DATAU3NU3R4NU3D3
171Ø DATAR2U6NL2NR2D6R2
172Ø DATABUNUFR2ENU5BD
173Ø DATAU3NU3RNE3F3
174Ø DATANU6R4
175Ø DATAU6F2DUE2D6
176Ø DATAU6F4NU4D2
177Ø DATABRHU4ER2FD4GNL2BR
178Ø DATAU6R3FDGL3D3BR4
179Ø DATABRHU4ER2FD4GNL2BUHF2
18ØØ DATAU6R3FDGL3RF3
181Ø DATABUFR2EUHL2HUER2FBD5
182Ø DATABU6R4L2D6BR2
183Ø DATABUNU5FR2ENU5BD
184Ø DATABU6D4F2E2U4BD6
185Ø DATANU6E2UDF2NU6
186Ø DATAUE4NUG2H2NUF4D
187Ø DATABU6DF2E2NUG2D3BR2
188Ø DATABU6R4DG4DR4
1999 'read scores from disk
2ØØØ IFPEEK(188)=6THENRETURN
2Ø1Ø OPEN"I",#1,"TTSCORES/T1Ø"
2Ø15 IF EOF(1)=-1 THEN2Ø5Ø
2Ø2Ø FORZQ=1TO1Ø
2Ø3Ø INPUT#1,S(ZQ)
2Ø35 INPUT#1,S$(ZQ)
2Ø4Ø NEXTZQ
2Ø5Ø CLOSE#1
2Ø6Ø RETURN
2999 'write scores to disk
3ØØØ IFPEEK(188)=6THENEND
3Ø1Ø OPEN"O",#1,"TTSCORES/T1Ø"
3Ø2Ø FORZQ=1TO1Ø
3Ø3Ø WRITE#1,S(ZQ)
3Ø35 WRITE#1,S$(ZQ)
3Ø4Ø NEXTZQ
3Ø5Ø CLOSE#1
3Ø6Ø END
```


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Talk About Your Chopped Down Ford!

By Joel Robbins



One thing I keep forgetting and relearning on CoCo is almost nothing is impossible. Although I had written many programs and done "the impossible" many times, when my son asked me to create a car designing program, I told him it would be too hard and complicated. I just thought that all of the dimensions, angles, circles and interconnected lines would make it a real headache.

Two months passed before I ran out of other programming projects. Frustrated at not having a program to work on, I finally and half-heartedly sat down to begin writing *Autodesigner*. To my amazement it was basically done in two evenings.

The real guts of the program are from lines 78 to 94. Line 79 draws the bottoms of the cars, which are always the same length. To make the cars look shorter, the vertical dimensions are lengthened. After line 85 all of the *LINE* commands contain only the second coordinate, which makes this section look so uncomplicated.

The one complicated part was thinking only in variables (EE, GR, etc.) and making sure that the new input was added to or subtracted from the correct previous input before the dimensions were set to the graphics generating routine. Labeling lines 85 through 91 with *REM* (') statements helped me keep things straight.

The inputting of dimensions, and the feature which allows the user to change one dimension without changing the others, turned out to occupy the largest amount of space (lines 18 to 73 and 96 to 102).

I added the sample design option last. The dimensions for it are located in line 108. The section makes it much easier to become acquainted with the workings of *Autodesigner* and gives the program an early graphics display.

A few standard menus and directions were the finishing touches. I knew my boy would like the program, but my friends who have seen it even like it more. It's that frustrated car designer in all of us. I used to want to be an architect, too. In fact, my wife thought that I should write a program that would design houses. Is she kidding? All of those dimensions, rectangles and interconnected lines would make it a headache to program.

(Joel Robbins has been enjoying the color computer for about a year and a half, and has published a number of his programs. He has a wife and two children and teaches high school literature.)



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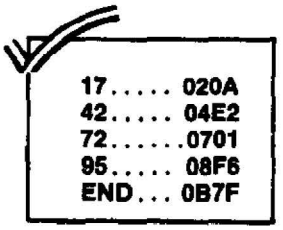
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ND DESIGN     YOUR OWN CARS. THE
NUMBERS IN    () ARE SUGGESTED LI
MITS. ALL     OF THE DIMENSIONS A
RE INNER-     RELATED SO PLAN ACC
ORDINGLY."
8 PRINT@288,"  YOU CAN CHANGE TH
E DESIGN AT   ANY TIME BY TOUCHI
NG <ENTER>.
9 PRINT@416," TOUCH <S> FOR SAMP
LE DESIGN     OR <N> FOR NEW DES
IGN."
10 SA$=INKEY$
11 IFSA$="S"THEN108
12 IFSA$="N"THEN14
13 GOTO 10
14 CLEAR
15 IU=1
16 CLS
17 GOTO 23
18 PRINT:CLS:PRINT"           CHAN
GES"
19 PRINT "FRONT WH = 1      REAR
WH = 2    BTWN WHEELS = 3  GRILL
E HI = 4  HOOD LENGTH = 5 HOOD S
LOPE = 6  WNDSHLD HI = 7   WNDSH
LD SL = 8 ROOF LENGTH = 9  BCK W
ND HI = 10BCK WND SL = 11  TRUNK
 LEN = 12 TRUNK SLOPE = 13 PAINT
 = 14
20 INPUT IN
21 IFIN>14THEN20
22 ON IN GOTO 23,25,29,33,37,41,
45,49,53,57,61,65,69,73
23 INPUT "SIZE OF FRONT WHEEL(10
-40)";FW
24 WF=FW
25 INPUT "REAR WHEEL(10-40)";RW
26 WR=RW
27 IFIU=1THEN29
28 GOSUB 104
29 INPUT "DISTANCE BETWEEN WHEEL
S(50-180)";A
30 AB=A:A=A/2:A=120-A:B=A+AB
31 IFIU=1THEN33
32 GOSUB 104
33 INPUT "HEIGHT OF GRILLE(0-70)
";GR
34 GR=170-GR
35 IFIU=1THEN37
36 GOSUB104
37 INPUT "LENGTH OF HOOD(0-120)"
;EE
38 EE=EE+5
39 IFIU=1THEN41
40 GOSUB 104
41 INPUT "SLOPE OF HOOD(0-50)";F
F
42 FF=GR-FF
43 IFIU=1THEN45
44 GOSUB 104
45 INPUT "HEIGHT OF WINDSHIELD(0
-40)";HH
46 HH=FF-HH
47 IFIU=1THEN49
48 GOSUB 104
49 INPUT "SLOPE OF WINDSHIELD(0-
50)";GG
50 GG=EE+GG
51 IFIU=1THEN53
52 GOSUB 104
53 INPUT "LENGTH OF ROOF(0-90)";
II
54 II=GG+II
```

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```
55 IFIU=1THEN57
56 GOSUB 104
57 INPUT "HEIGHT OF BACK WINDOW(
0-50)";LL
58 LL=HH+LL
59 IFIU=1THEN61
60 GOSUB 104
61 INPUT "SLOPE OF BACK WINDOW(-
30 TO +30)";KK
62 KK=II+KK
63 IFIU=1THEN65
64 GOSUB 104
65 INPUT "LENGTH OF TRUNK(0-50)"
;MM
66 MM=KK+MM
67 IFIU=1THEN69
68 GOSUB 104
69 INPUT "SLOPE IF TRUNK(-10 TO
30)";MN
70 MN=LL+MN
71 IFIU=1THEN73
72 GOSUB 104
73 INPUT"PAINT(1-4)";ZP:IFZP>4TH
EN73
74 IFIU=1THEN 76
75 GOSUB 104
```


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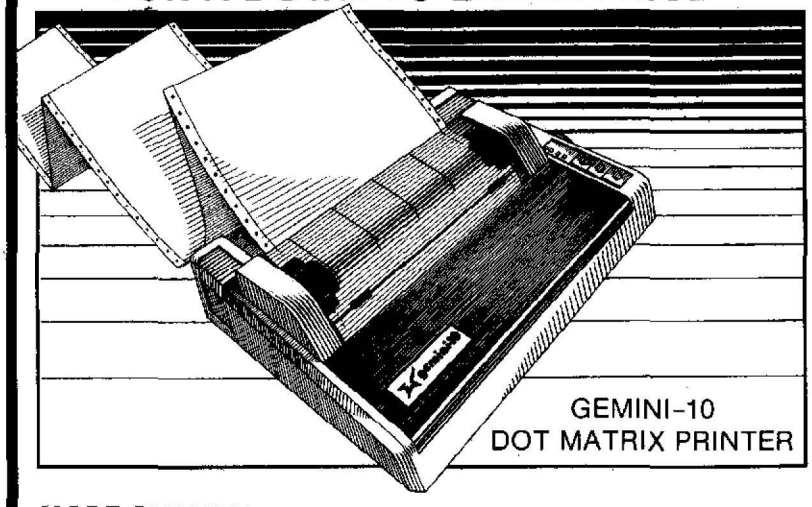
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```
76 PCLS
77 SCREEN 1,0
78 LINE(0,180)-(255,180),PSET
79 LINE(0,170)-(255,170),PSET
80 PAINT(10,181),3,4
81 CIRCLE(A,180-WF),FW,0'FRONT W
HEEL
82 CIRCLE(A,180-WF),3,0
83 CIRCLE(B,180-RW),WR,0'REAR WH
EEL
84 CIRCLE(B,180-RW),3,0
85 LINE(0,170)-(5,GR),PSET'GRILL
86 LINE-(EE,FF),PSET 'HOOD
87 LINE-(GG,HH),PSET 'WINDSHIELD
88 LINE-(II,HH),PSET'ROOF
89 LINE-(KK,LL),PSET'BACK WINDOW
90 LINE-(MM,MN),PSET'TRUNK
91 LINE-(255,170),PSET'BACK BUMP
ER
92 PAINT(120,169),ZP,0
93 PAINT(10,169),ZP,0
94 PAINT(240,169),ZP,0
95 GOSUB110
96 BS$=INKEY$
97 IF BS$=""THEN96ELSE98
98 CLS:PRINT@32,"TOUCH <C> TO CH
ANGE DESIGN      TOUCH <N> FOR N
EW START"
99 PU$ = INKEY$
100 IU=0
101 IF PU$="C"THEN18
102 IFPU$="N"THEN5ELSE99
103 END
104 INPUT"TOUCH <D> FOR DESIGN O
R <ENTER> TO MAKE OTHER CHANGES"
; IP$
105 IF IP$ ="D"THEN76ELSERETURN
106 PRINT@32,"ADD DESIGN FEATURE
S IN LINE 2000"
107 PAINT(110,160),0,0
108 ZP=3:WR=22:RW=22:FW=20:WF=20
:A=180:AB=A:A=A/2:A=120-A:B=A+AB
:GR=140:EE=100:FF=120:HH=90:GG=1
20:II=170:LL=120:KK=190:MM=240:M
N=140
109 GOTO 76
110 WH=WR:HW=FW
111 IF WR<6THENRETURN
112 IFFW<6THENRETURN
113 FORTI=1TO6
114 HW=HW-1
115 CIRCLE(A,180-WF),HW,0
116 NEXTTI
117 FORTI=1TO6
118 WH=WH-1
119 CIRCLE(B,180-RW),WH,0
120 NEXT TI
121 IFTI=0THENTI=1ELSETI=0
122 IFTI=0THENRETURN
123 GOTO 76
```

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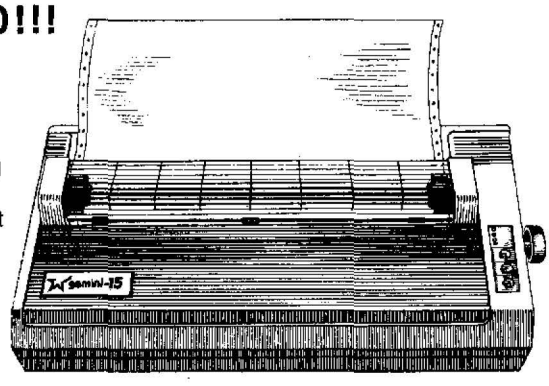
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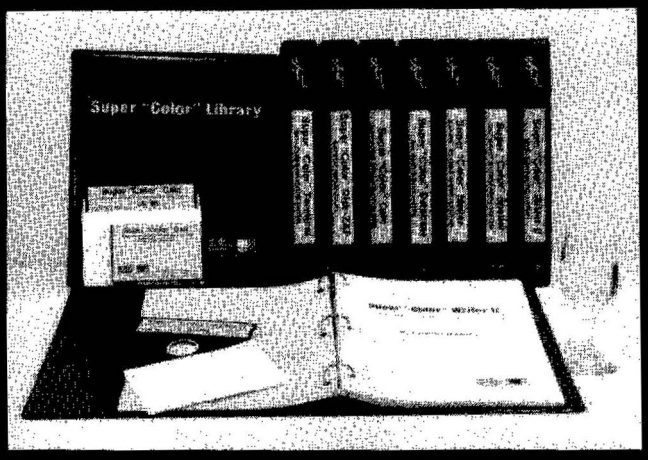
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RAINBUG IV

Part four of a series on our new machine language monitor being developed by the author, *Rainbow* Technical Editor, Dan Downard



To a machine language programmer the most noticable omission in Non-Extended BASIC is a utility for saving binary programs on the cassette recorder. This month, we are going to add all of the tape commands, *Punch, Load* and *Verify* along with a disk "zapper" for the floppy crowd. At the same time, we will finish our review of the 6809 microprocessor commands by discussing interrupts and the condition code register (CC).

Before we start I would like to mention a bug in *EDTASM+*. For some unknown reason, the assembler translates the LDA ,X instruction improperly when converting it to machine code. Always use the form LDA 0,X when assembling this instruction, it will save you a lot of debugging. If you have been following this series, you probably have noticed that I use *EDTASM+* for assembling *Rainbug*. For the beginner, I would recommend purchasing the ROM Pack as an excellent method of getting your feet wet. It lacks some of the features found in disk-based assemblers, but is easy to operate and comes with excellent instructions. There have been several rumors of a Radio Shack disk-based Editor-Assembler for the CoCo, but I guess we will have to wait for the "super" CoCo to get one. For those of you with a disk and *EDTASM+*, I would recommend Roger Schrag's "Patching EDTASM+ to Run on Disk" in the December 1982 *Rainbow*. It works fine.

What do you need to get started in machine language programming? With the *EDTASM+* ROM Pack, *SDS80C*, or for that matter, any of the editor-assembler tapes advertized, all you need is a 4K Non-Extended BASIC CoCo. If you just want to enter a ML program into memory out of a magazine article all you need is a monitor such as *Rainbug*. Machine language will run on any 6809 computer with minor modifications. For small programs, usually the only changes necessary are to the routines, or addresses, that input from the keyboard and output to the screen.

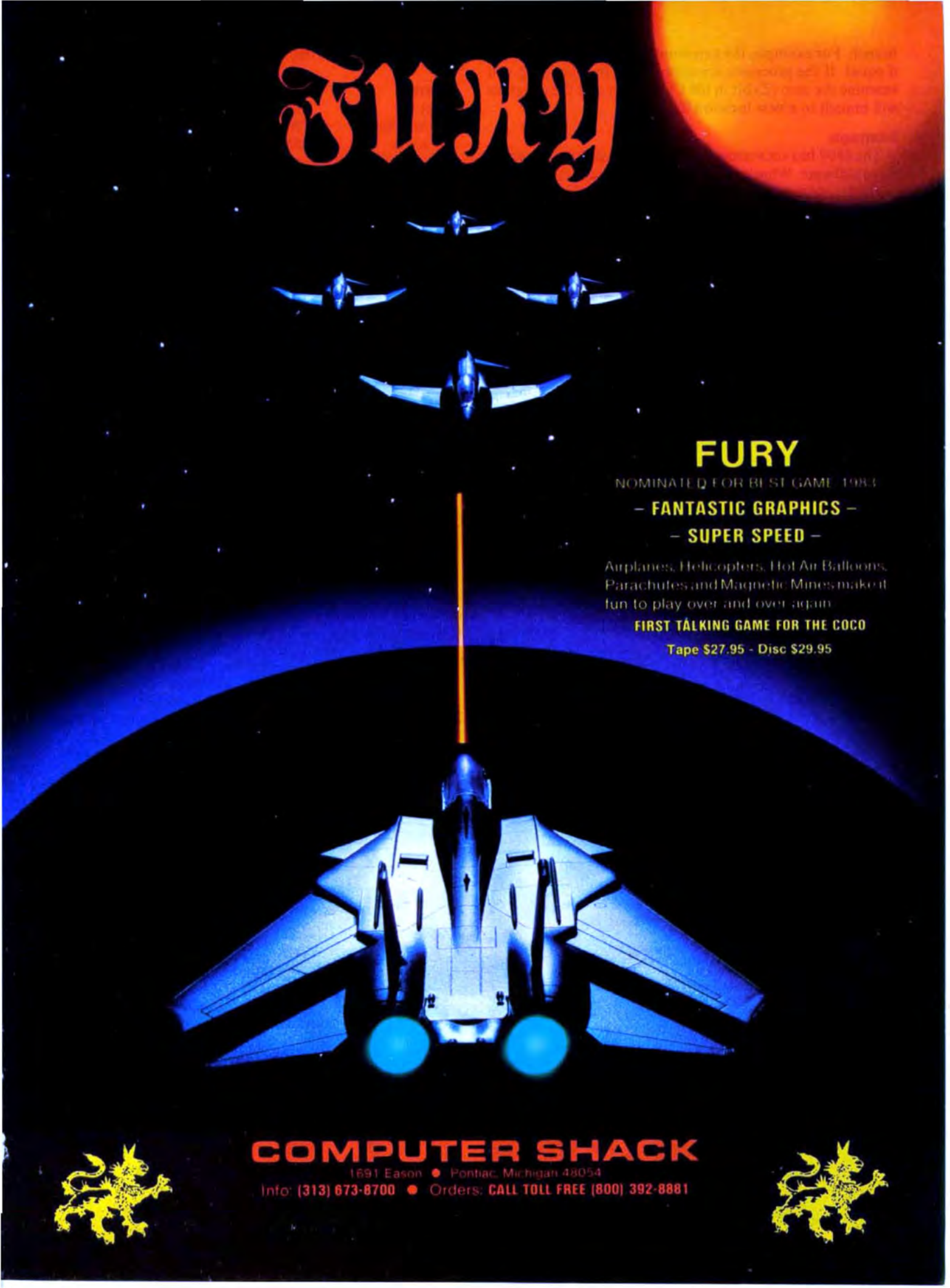
(Dan Downard is an electrical engineer and has been involved in electronics for 24 years through ham radio (K4KWT). His interest in computers began about five years ago and he has built several 68XX systems.)

Condition Codes

The Condition Code Register (CC) is an internal 8-bit register within the 6809 processor used to indicate the result of instructions or operations. Each bit has a separate function and five of these bits are set/reset depending on the previous data instruction. They are the half carry (H), negative (N), zero (Z), overflow (V) and carry (C) bits. Two of the bits are related to interrupts: the fast interrupt request mask (F) and the interrupt request mask (I). The entire flag (E) reflects the status of the stack pointer.

Flag	Bit#	Description
C	0	A carry or borrow was generated by the previous operation.
V	1	A signed arithmetic overflow was caused by the last operation.
Z	2	The result of previous operation was zero.
N	3	Contains the value of bit 7 from the previous operation.
H	5	A carry was generated by bit 3.
F	6	Used to mask the FIRQ line.
I	4	Used to disable any IRQ input.
E	7	Indicates how many registers were saved by the last interrupt.

Condition codes are generally used to control the flow of the program. They are the elementary form of the *IF . . . THEN* statement. Most of the time they are combined with a branch statement to form what is called a conditional


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branch. For example, the nmemonic BEQ stands for branch if equal. If the processor encounters this instruction it will examine the zero (Z) bit in the CC register and the program will branch to a new location if it is set.

Interrupts

The 6809 has six vectored interrupts, three hardware and three software. What's an interrupt? What's a vector? Sometimes during a normal program we wish external inputs to halt program execution and perform another task. An example would be an action game. While the processor is busy updating graphics on the screen how does it know that the fire button has been pressed?

A hardware interrupt is a dedicated input into the processor that stops program execution, performs another task, and then restores the program counter to its previous value. A software interrupt does the same thing when certain instruction codes are encountered.

"Vectored" means that, when the processor recognizes an interrupt, the program counter is pointed to a certain address for further action. The reset button on the rear of your computer is actually a vectored interrupt. When you depress the reset, the processor jumps to the address stored at location $FFFE. Examining assress $FFFE will give you the start of BASIC, or $A027.

Another interrupt that is used in the CoCo is the FIRQ. Pin 8 of the cartridge connector is indirectly connected to the FIRQ line of the 6809 to indicate the presence of a ROM Pack. When a FIRQ interrupt is recognized program execution is transferred to $C000 or the address of the ROM Pack.

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Following are the 6809 interrupts:

Interrupt	Nmemonic	Vector
Reset	RESET	$FFFE
Non-maskable	NMI	$FFFC
Software	SWI	$FFFA
Interrupt Request	IRQ	$FFF8
Fast Int. Request	FIRQ	$FFF6
Software 2	SWI2	$FFF4
Software 3	SWI3	$FFF2

Rainbug

This month we are going to add several new commands to *Rainbug*. They consist of tape loading, saving and verification, disk examination and printer control. The new commands can be used as follows:

@— Toggle printer on or off. This command must be entered following a prompt.

P— xxxx yyyy zzzz filename-Save a mahine language binarry format file. xxxx=starting address,yyyy=-ending address, zzzz=execute address. Filename must meet BASIC specifications.

L— Same as BASIC *CLOADM* command.

V— Same as BASIC *SKIPF* command.

D(X)— Read/write to disk. X=R for read. X=W for write.

All of the commands are self-explanatory with the exception of the D(X) command. After a DR command, you are prompted for the drive, track and sector which must be entered in HEX. The data in this sector of the disk will be transferred to a buffer located at $2000-$20FF where it may be examined or changed using the M command. After the data is changed it can be written back to any sector using the DW command. Be careful!

Summary

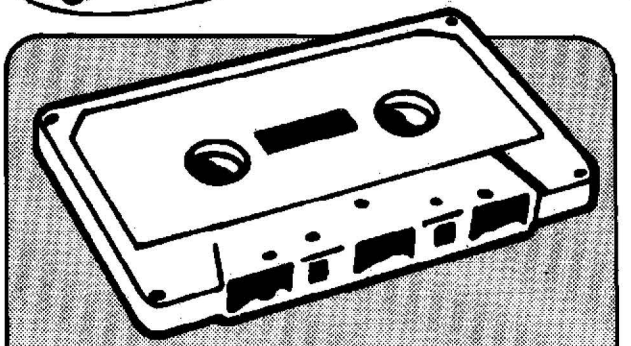
Next month, we will wrap up *Rainbug* with the program execution and breakpoint commands. I will try to show you how to use some of the routines already in the BASIC ROMS for your own ML programs. Also, some tips on modifying existing programs will be discussed. If you have any questions or suggestions of future topics that need discussion, please write in care of the magazine.

```
                        00100 *RAINBUG
                        00110 *DAN DONNARD     REV 3
                        00111 *LINES 100-2550 AND LINES
                        00112 *2805-3990 APPEARED IN PARTS
                        00113 *1,2 AND 3 OF THIS SERIES
3000                    00120         ORG     $3000
                        02555 *TABLE OF COMMANDS
            3205        02560 CMDTBL  EQU     *
3205        42          02570         FCC     /B/
3206        0281        02580         FDB     BKPT-*
3208        43          02590         FCC     /C/
3209        01FF        02600         FDB     CALL-*
320B        44          02610         FCC     /D/
320C        017C        02620         FDB     DISK-*
320E        45          02630         FCC     /E/
320F        0054        02640         FDB     ENCDE-*
3211        47          02650         FCC     /G/
3212        01F7        02660         FDB     GO-*
3214        4C          02670         FCC     /L/
3215        72E9        02680         FDB     LOAD-*
3217        4D          02690         FCC     /M/
```

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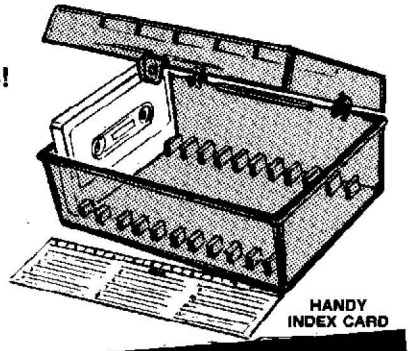
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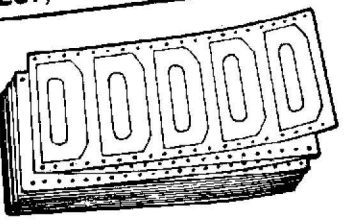
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```
3218  FDE8  02700      FDB  CMEM-*
321A  40    02710      FCC  /@/
321B  00E5  02720      FDB  PRINT-*
321D  4F    02730      FCC  /O/
321E  0017  02740      FDB  OFFS-*
3220  50    02750      FCC  /P/
3221  00ED  02760      FDB  PUNCH-*
3223  52    02770      FCC  /R/
3224  01E6  02780      FDB  RES-*
3226  53    02790      FCC  /S/
3227  01E4  02800      FDB  STLEV-*
3229  54    02810      FCC  /T/
322A  01E2  02820      FDB  TRACE-*
322C  56    02830      FCC  /V/
322D  73BF  02840      FDB  VER-*
322F  57    02850      FCC  /W/
3230  FE5C  02860      FDB  CWINDO-*
3232  58    02870      FCC  /X/
3233  002A  02880      FDB  EXIT-*
                  03995 *CONSTANTS AND ROM CALLS
32F8  0002  04000 BEGA  FDB  2
32FA  0002  04010 ENDA  FDB  2
      2000  04020 DBUF  EQU  $2000
32FC        04021 RN    RMB  1
32FD        04022 DR    RMB  1
32FE        04023 TR    RMB  1
32FF        04024 SE    RMB  1
      A390  04025 NAME  EQU  $A390
      01D2  04026 NAM   EQU  $01D2
            A46C  04027 COUT  EQU  $A46C
                  04028 *VERIFY (SAME AS SKIPF)
            A5EC  04030 VER   EQU  $A5EC
                  04035 *LOAD (SAME AS CLOAD)
            A4FE  04040 LOAD  EQU  $A4FE
                  04045 *TURN PRINTER OFF/ON
3300 96 6F        04050 PRINT LDA  $6F
3302 81 FE        04060       CMPA #$FE
3304 26 03        04070       BNE  CHA
3306 0F 6F        04080       CLR  $6F
3308 39           04090       RTS
3309 86 FE        04100 CHA   LDA  #$FE
330B 97 6F        04110       STA  $6F
330D 39           04120       RTS
                  04125 *CSAVEN ROUTINE
                  04126 *GET START, END & EXEC
330E 17 FE2E      04130 PUNCH LBSR CONUM
3311 FD 32F8      04140       STD  BEGA
3314 17 FE28      04150       LBSR CONUM
3317 FD 32FA      04160       STD  ENDA
331A 17 FE22      04170       LBSR CONUM
331D FD 01E5      04180       STD  $01E5
3320 BD A390      04190       JSR  NAME
3323 C6 08        04200       LDB  #8
3325 108E 01D2    04210       LDY  NAM
3329 30 01        04220       LEAX 1,X
332B A6 80        04230 PU1   LDA  ,X+
332D 81 3A        04240       CMPA #$3A
332F 24 04        04250       BHS  PU2
```


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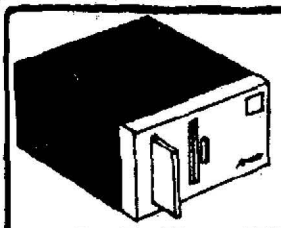
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```
3331 30  1F     04260       LEAX   -1,X
3333 86  20     04270       LDA    #$20
3335 A7  A0     04280 PU2   STA    ,Y+
3337 5A         04290       DECB
3338 26  F1     04300       BNE    PU1
                04305 *SAVE TO CASSETTE
333A AE  8C B8  04310       LDX    BEGA,PCR
333D 9F  19     04320       STX    $19
333F BF  01E7   04330       STX    $01E7
3342 AE  8C B5  04340       LDX    ENDA,PCR
3345 30  01     04350       LEAX   1,X
3347 9F  1B     04360       STX    $1B
3349 86  02     04370       LDA    #2
334B 8E  0000   04380       LDX    #0
334E BD  A46C   04390       JSR    COUT
3351 17  FE2F   04400       LBSR   PCRLF
3354 39         04410       RTS
                04412 *DISK PROMPTS
3355     44     04415 DMS01 FCC    /DRIVE#(HEX)/
         52
         49
         56
         45
         23
         28
         48
         45
         58
         29

3360     04     04416       FCB    $04
3361     54     04420 DMS02 FCC    /TRACK#(HEX)/
         52
         41
         43
         4B
         23
         28
         48
         45
         58
         29
336C     04     04421       FCB    $04
336D     53     04430 DMS03 FCC    /SECTOR#(HEX)/
         45
         43
         54
         4F
         52
         23
         28
         48
         45
         58
         29
3379     04     04431       FCB    $04
337A     41     04440 DMS04 FCC    /ARE YOU SURE?/
         52
         45
```


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Sugar Software

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Auto Run	14.95	**11.95**	
Tims Mail	19.95	**15.95**	**23.95**
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Stagraph	24.95	**19.95**	**27.95**
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Silly Syntax (Tape)	19.95	**15.95**	
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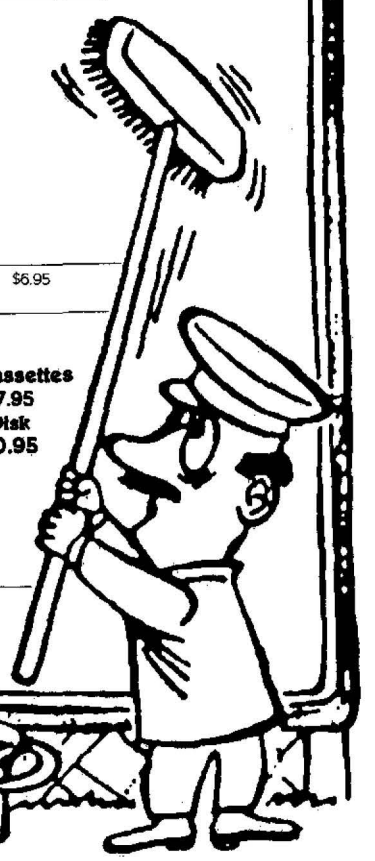
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52
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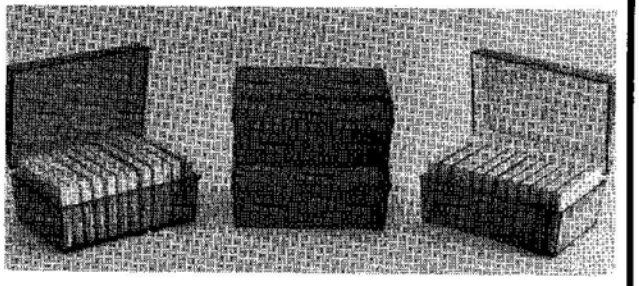
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```
                45
                3F
3387            #4          #4441           FCB     #$4
                            #4445 *DISK READ OR WRITE?
3388 17         FDE3        #4450 DISK      LBSR    INCH
338B 81         52          #4460           CMPA    #$52
338D 26         07          #4470           BNE     WRITE
338F 86         02          #4480           LDA     #2
3391 B7         32FC        #4490           STA     RW
3394 20         1A          #4500           BRA     DIO
3396 81         57          #4510 WRITE     CMPA    #$57
3398 1026       FE0C        #4520           LBNE    ERROR
339C 86         03          #4530           LDA     #3
339E B7         32FC        #4540           STA     RW
33A1 8E         337A        #4550           LDX     #DMSG4
33A4 17         FDDF        #4560           LBSR    PDATA
33A7 17         FDC4        #4570           LBSR    INCH
33AA 81         59          #4580           CMPA    #$59
33AC 1026       FDF8        #4590           LBNE    ERROR
33B0 8E         3355        #4600 DIO       LDX     #DMSG1
33B3 17         FDD0        #4610           LBSR    PDATA
33B6 17         FCDA        #4620           LBSR    BLDNNB
33B9 B6         319A        #4625           LDA     NUMBER+1
33BC B7         32FD        #4630           STA     DR
33BF 8E         3361        #4640           LDX     #DMSG2
33C2 17         FDC1        #4650           LBSR    PDATA
33C5 17         FCCB        #4660           LBSR    BLDNNB
33C8 B6         319A        #4665           LDA     NUMBER+1
33CB B7         32FE        #4670           STA     TR
33CE 8E         336D        #4680           LDX     #DMSG3
33D1 17         FDB2        #4690           LBSR    PDATA
33D4 17         FCBC        #4700           LBSR    BLDNNB
33D7 B6         319A        #4705           LDA     NUMBER+1
33DA B7         32FF        #4710           STA     SE
                            #4715 *USE DSKCON FOR I/O
33DD BE         C004        #4720           LDX     $C004
33E0 B6         32FC        #4730           LDA     RW
33E3 A7         00          #4740           STA     0,X
33E5 B6         32FD        #4750           LDA     DR
33E8 A7         01          #4760           STA     1,X
33EA B6         32FE        #4770           LDA     TR
33ED A7         02          #4780           STA     2,X
33EF B6         32FF        #4790           LDA     SE
33F2 A7         03          #4800           STA     3,X
33F4 CE         2000        #4810           LDU     #DBUF
33F7 EF         04          #4820           STU     4,X
33F9 AD         9F C004     #4830           JSR     [$C004]
33FD 7F         FF40        #4840           CLR     $FF40
3400 6D         06          #4850           TST     6,X
3402 1026       FDA2        #4860           LBNE    ERROR
3406 39                     #4870           RTS
                            #4875 *RTS FOR FUTURE COMMANDS
3407 39                     #4880 BKPT      RTS
3408 39                     #4890 CALL      RTS
3409 39                     #4900 GO        RTS
340A 39                     #4910 REG       RTS
340B 39                     #4920 STLEV     RTS
340C 39                     #4930 TRACE     RTS
                3000        #4940           END     CMEM
00000 TOTAL ERRORS
```

Sugar Software

AUTO RUN

Auto Run is a utility program for the TRS-80* Extended Basic Color Computer. It is used to add convenience and professionalism to your software.

Auto Run will help you create your title screen with the graphics editor. The graphics editor allows you to choose a background color and border style. Using the arrow keys and several other commands you can draw pictures, block letters and also include text.

Auto Run will generate a machine language loader program to precede your program on the tape. Then, to start up your program, simply type CLOADM to load in the Auto Run loader program, which will then automatically start itself up, display your title screen, load your program and then RUN or EXEC it.

Also you may record a vocal or musical introduction preceding your program. The Auto Run loader will control the audio on/off.

Basic programs can be set to load anywhere in memory above $600 (the PCLEAR 0 page).

Software authors: The Auto Run prefix may be appended to your software products.

Auto Run is **$19.95** and includes complete documentation and an assembly source listing. Requires 16K Extended Basic.

Galactic Hangman



A great new twist to the popular, educational word guessing game for the Color Computer. Large (700 words) and sophisticated vocabulary. Or enter your own words, your child's spelling list, foreign language vocabulary, etc.

Outstanding high resolution graphics, animation and sound effects.

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A user-oriented, easy to use personal database management system for the TRS-80* Color Computer with these outstanding features:

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*up to 230 characters per record

For **$24.95** you get the database management system, our full documentation which includes a reference guide and a programmer's guide, and our 1981 Bibliography of articles relating to the Color Computer. Requires 16K Extended Basic. 32K recommended.

1982 TIMS Bibliography — $9.95

Silly Syntax



A sensational and educational version of a popular party game for the TRS-80* Color Computer . . .

For 1 to 10 players. Load a story into the computer. The players are asked to supply a noun, verb, part of body, celebrity, etc. which the program uses to complete the story. The story, which is displayed when all words are entered, will be hilarious. Silly Syntax requires 16K Extended Basic (32K for disk version). For **$19.95**, you get a user guide and a tape containing the Silly Syntax game and 2 stories. You can create your own stories or order story tapes from the selection below.

Silly Syntax stories — Ten stories per tape.

SS-001 - Fairy Tales	SS-004 - Current Events
SS-002 - Sing Along	SS-006 - Adventure/Sci-Fi
SS-003 - X-Rated	SS-007 - Potpourri

Each story tape is **$9.95**. 10% off for 3 or more story tapes. Disk is **$24.95** for Silly Syntax and 2 stories or **$49.95** for Silly Syntax and all 62 stories.

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UN-BELIEVABLE

But true! There *is* a disk drive in your Color Computer . . . and it is faster and more efficient than any "hardware" drive you can buy, for any price. This new "disk drive" is called VDOS—for Virtual Disk Operating System—and it will absolutely revolutionize the way you operate your CoCo.

VDOS lets you use the "extra" memory inside your CoCo as a virtual disk, with programs (any programs) stored out of the way. You can "save" and "load" programs from your in-memory disk into working memory, and then run them. When you're done, you can simply access your in-memory disk again . . . and save or load another, and another.

And VDOS is fast. Because you are using memory rather than a mechanical device (like a disk drive or cassette player), programs load instantly. Yes, VDOS is faster than a disk!

VDOS works with all Color Computers—from 16K non-extended to 64K extended. Obviously, the more memory you have, the greater number (and length) of programs you can store. For a 64K system, VDOS also uses the "unused" part of memory, providing up to 50,000 bytes of storage! Now, that's some disk!

We call it VDOS because in the future there will be utilities for your VDOS UNDISK that will give even greater capabilities—such as a full one-pass memory dump to cassette. Other utilities are planned, too.

We believe VDOS is the greatest advancement for CoCo since the introduction of the disk drive itself. And, at less than $100, it is so inexpensive you can't afford to be without it. If you have the "cassette blues," VDOS *is* the answer!

Finally, VDOS is simple to operate. It is entirely self-prompting and comes with a complete manual. But you almost don't even need the instructions—it requires absolutely no technical expertise.

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RAINBOW

TWO FOR THE 10

A Pair of programs for the new MC-10 demonstrate some useful techniques.

By Thomas Szlucha

Move over VIC, shove down ZX-81, here comes the MC-10, Micro Color Computer by Radio Shack. It is about time Tandy paid serious attention to the $100 computer market. The original CoCo is a bit overpriced for this important "learners" category. The addition of the Micro Color with its salient features should serve well in rounding out Tandy's fleet. One of the two features that I believe set this micro apart from its main competitors is the built in RS-232 communication port for modem or printer hook-up. The other is a decent version of Color BASIC (by Microsoft). This version has some math function enhancements over the original Color BASIC and should serve well as an introductory language. There are some commands missing as well as some hidden commands which will be described in a future article.

This article is not meant to be a review of the Micro CoCo, but a presentation of some programs designed to help owners, who are likely new to computing, put this excellent machine to work.

The first program, shown in Listing 1, is called *MCmaze*. It is a game that demonstrates techniques which can be useful in building BASIC games. The first technique that should be mentioned as you study the listing is the use of multiple statement lines, a technique only vaguely mentioned in the MIC (a new nickname?) instruction manual. Multiple statement lines are useful in conserving memory space, saving a line number each time one is used. To separate functions, the colon (:) is used. Lines 70 and 80 of the maze program are good places to use (:), the *SET* statements separately would have taken up seven lines. Care should be used in applying this technique on lines with logical *IF* statements because program flow will continue to the end of the line only when the logic statement is satisfied. Also, do not make the lines too long, Micro Color BASIC only allows 128 bytes (characters) per line. If you are converting a program that you would like to compress, use care that you do not eliminate a needed *GOTO* line number by using multiple statements.

Back to *MCmaze*. Up through line 250, the instructions are presented and the maze is drawn. The car movement, lines 270-410, is the heart of this program. Lacking joystick controls on MIC, control of the car steering is provided by using the *INKEY$* command to sense pressing of certain keys on the keyboard. In the normal course of this program, looping is taking place constantly from lines 270-410. The keyboard is being sensed several times a second at line 280. The value of the key pressed is assigned to the variable IK$. (Note, the variable has a $ after it because this is a string variable, i.e., not treated as a normal number by MIC).

In the next line, there is a test to see if there was a key pressed. If so, the new value is passed to variable K$, if not then K$ keeps its old value. This is an important trick to keep the car moving between keyboard presses. Lines 300-330 check to see which direction and calculate a new position (X1, Y1) for the car each time through the loop. In line 340, the old position (X, Y) is turned off with the *RESET* command, otherwise you would draw a line on the screen corresponding to where the car has gone. This would be great for some programs, *Color Etch-a-Sketch* for instance, but not desired here. Lines 350 and 360 sense whether the car has reached the finish or crashed by looking at the color *POINT* of the new location the car is about to move to. If things are O.K., the new car position is *SET* (line 370) and the variables keeping track of the previous position of the car are updated in line 380. Before going around again, at line 400, a delay is added which is dependent on the level of difficulty requested. The program just sits there and counts to "D" allowing the game to be made easier for slow fingers.

The rest of the program consists of the various subroutines taking care of the crash count and finishing displays. Overall, even with all the *REM* statements used, this game takes less then one-half the memory available in MIC.

The second program, called *MCspell* (Listing 2), has a more serious purpose. This program is designed to help a child learn spelling by selecting the misspelled word out of a group of words. To maintain attention and concentration, the program has a game aspect in that the misspelled word is not simple picked out, but "shot down" with a "ray gun."

In designing this program, considerable use was made of data arrays. The focus of the program description will be explaining and handling arrays with the MC-10.

An array is a special type of variable that can have many different values and is used when you would like to treat it the same way (mathematically or logically) each time you use it in a program. The lists of words used in this spelling

---

(Mr. Szlucha, a technical specialist in Product Development at Xerox Corporation, holds several patents relating to xerography. Microcomputing is a hobby enjoyed by his whole family.)

program are excellent examples of the uses of arrays. The list of correct words keyed or read into this program are assigned to an array variable W$(n). Specifying the value of n, from 1 to 30 in this case will return a different word from the spelling list. For example:

W$(1) = "tree"
W$(2) = "grow"
W$(3) = "try"
to
W$(30) = "kite"

In this program, to keep the lists separate, two arrays are used W$(n) to store the "correct" words and MS$(n) to store the misspelled words. The value associated with each element of the array is entered one of two ways in this program. If the "key-in word list option" is chosen (line 400), then *INPUT* statements are used to enter the words from the keyboard. There is also an option to use "built-in" words. These words are read into the array using the *READ* command (lines 210 and 240). The words reside in *DATA* statements at the end of the program and can be changed if desired from BASIC.

When using an array, you must define for the computer the maximum size that is intended for the array. This is done with a dimension statement that is placed in the program prior to the use of the array variable. The computer sets aside the memory associated with the anticipated aray size. If you exceed the *DIM* or forget it, you will generate an error. There is one exception to this; arrays of 10 and less do not have to be dimensioned, space is made available for them automatically.

This program, as it currently exists, handles a total of 45 words. By changing the dimensions of the arrays and the various counting variables you could increase the list of words considerably.

These programs will increase the library of the new MC-10 owners and hopefully spark ideas for new programs. Welcome to a new computer and to the many friends that it will bring to a fascinating hobby.

Note: there are very few differences in dialect between Color BASIC and Micro Color BASIC. These programs should work on a 4K CoCo, but the following changes should be made to work correctly with the arrow keys.

MCmaze—Line 300 change "S" to CHR$(09)
Line 310 change "W" to CHR$(94)
Line 320 change "A" to CHR$(08)
Line 330 change "Z" to CHR$(10)

MCspell—Line 1140 change "S" to CHR$(09)
Line 1150 change "A" to CHR$(08)

Listing 1:

```
1 REM MAZE RACE
2 REM SUBMITTED BY
3 REM THOMAS SZLUCHA
4 REM FAIRPORT NY. 14450
5 REM
10 CLS0
20 GOSUB1010
30 INPUT"LEVEL OF DIFFICULTY (1-
3)";D:D=(3-D)*20+1
35 TI=0:C=0
40 CLS0
50 REM SET-UP MAZE AND BARRIERS
60 FOR I=0 TO 63
70 SET(I,0,4):SET(I,1,4):SET(I,2
8,4):SET(I,29,4)
80 SET(0,INT(I/2),4):SET(1,INT(I
/2),4):SET(62,INT(I/2),4):SET(63
,INT(I/2),4)
90 NEXT I
100 FOR J=4TO24 STEP4
110 RD=4+RND(24):RR=38+RND(22)
120 SET(RD,J-1,4):SET(RD+4+RND(3
0),J-2,4)
130 IFINT((J/4)/2)=(J/4)/2THEN14
0
135 GOTO170
140 FOR I=1TO57
150 SET(I,J,4):SET(I,J+1,4)
160 NEXT I:GOTO 200
170 FOR I=6TO62
180 SET(I,J,4):SET(I,J+1,4)
190 NEXT I
200 NEXT J
210 SET(0,27,2)
220 REM INITIAL LOCATION OF CAR
230 X=60:Y=3
250 SET(X,Y,1)
260 REM MAIN LOOP WHICH MOVES CA
R (TO LINE 410)
270 X1=X:Y1=Y
280 IK$=INKEY$
```


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```
10 PRINT"EXAMPLE": FORX=ATO M:FORY=STO
P:Z=X+Y:PRINTZ:NEXTY:NEXTX
```

Into this: –

```
10 PRINT "EXAMPLE":
     FOR X = A TO M:
        FOR Y = S TO P:
           Z = X + Y:
           PRINT Z:
        NEXT Y:
     NEXT X
```

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```
290 IF IK$<>"" THEN K$=IK$
300 IF K$="S" THEN X1=X+1
310 IF K$="W" THEN Y1=Y-.5
320 IF K$="A" THEN X1=X-1
330 IF K$="Z" THEN Y1=Y+.5
340 RESET(X,Y)
350 IF POINT(X1,Y1)=4 THEN GOTO
500
360 IF POINT(X1,Y1)=2 THEN GOTO
600
365 SOUND 10,1
370 SET(X1,Y1,5)
380 X=X1:Y=Y1
390 TI=TI+1:PRINT@480,"TIME";TI;
400 FORT=1TOD*2:NEXT
410 GOTO270
500 C=C+1:PRINT@493,"CAR #";C;"C
RASHED";
510 FOR T=1 TO 1000:NEXT T:PRINT
@480,"
   ";
520 K$=""
530 IFC=3THENGOTO620
540 GOTO 230
600 PRINT@480,"FINISHED COURSE!
TIME=";TI;
610 GOTO630
620 PRINT@480,"TIME =";TI"TO WRE
CK THREE CARS";
630 FOR T=1 TO 1000:NEXT T:PRINT
@480,"PLAY AGAIN <Y>/<N>
   ";:INPUT R$
640 IFR$="Y"THENCLS0:GOTO30
650 END
1000 REM INSTRUCTIONS
1010 PRINT"AVOID WALLS AND BARRI
ERS. IF YOUCRASH YOU START AT TH
E BEGINNINGAGAIN ";
1020 PRINT"- YOU HAVE THREE CARS
 AND WILL BE TIMED, NOTE:THE LEV
EL OF DIFFICULTY =  SPEED"
1030 PRINT
1040 RETURN
```


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MC-10

Listing 2:

```
10 REM MICSPELL
20 REM WRITTEN BY
30 REM THOMAS SZLUCHA
40 REM FAIRPORT NY. 14450
50 REM 5/29/83
90 DIM W$(30),MS$(15)
100 CLS
105 PRINT@73,"MICRO-SPELLER"
110 PRINT@138,"SELECTIONS"
130 PRINT@192,"<1> READ BUILT-IN
 WORD LIST"
140 PRINT"<2> KEY-IN WORD LIST
150 PRINT" "
160 INPUT R
170 IF R<1 OR R>2 THEN 160
180 ON R GOTO 200,400
200 FOR I=1 TO 30
210 READ W$(I)
220 NEXT I
230 FOR I=1 TO 15
240 READ MS$(I)
250 NEXT I
260 GOTO 1000
400 CLS:PRINT@68,"CREATE SPELLIN
G LIST"
410 PRINT" DATA ARRAYS CONSIST O
F :         30 - CORRECTLY SPELLE
DD WORDS    15 - MISSPELLED WORDS
"
430 N$="CORRECT"
440 FOR I=1 TO 30
450 GOSUB 600
460 NEXT I
470 N$="INCORRECT"
475 T=1
480 FOR I=1 TO 15
490 GOSUB 600
500 NEXT I
510 PRINT"FINISHED"
520 PRINT"PRESS ANY KEY TO PLAY"
```

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```
:INPUT R$:GOTO 1000
600 PRINT@384,"ENTER ";N$;" WORD
 #";I
605 IF T=1 THEN INPUT MS$(I):GOT
O 615
610 INPUT W$(I)
615 PRINT@416,"                "
620 RETURN
999 REM MAIN PROGRAM
1000 CLS0
1010 N=N+1
1015 R1=RND(15)
1020 R2=RND(15)+15
1025 R3=RND(15)
1040 P=RND(3)
1050 A$=W$(R1):B$=W$(R2)
1060 C$=MS$(R3)
1070 IF P=1 THEN PRINT@226,C$:PR
INT@236,B$:PRINT@246,A$
1080 IF P=2 THEN PRINT@226,B$:PR
INT@236,C$:PRINT@246,A$
1090 IF P=3 THEN PRINT@226,A$:PR
INT@236,B$:PRINT@246,C$
1100 PRINT@36,"SHOOT THE MISSPEL
LED WORD"
1110 PRINT@100,"MOVE GUN WITH AR
ROW KEYS          SHOOT BY PRESSIN
G SPACE BAR"
1115 X1=24
1120 SET(2+X1,31,4):SET(4+X1,31,
4):SET(6+X1,31,4):SET(4+X1,30,4)
:SET(4+X1,29,4)
1125 X=X1
1130 K$=INKEY$:IF K$="" THEN 113
0
1140 IF K$="S" THEN X1=X+20:IF X
1>44 THEN X1=44
1150 IF K$="A" THEN X1=X-20:IF X
1<0 THEN X1=4
1155 IF K$=" " THEN 1300
1160 RESET(2+X,31):RESET(4+X,31)
:RESET(6+X,31):RESET(4+X,30):RES
ET(4+X,29)
1250 GOTO 1120
1300 FOR Y=29 TO 16 STEP-1
1310 SET(X+4,Y,5)
1320 NEXT Y
1330 H=H+1
1360 IF INT(X/20)+1 =P THEN 1400
1370 SOUND50,4:SOUND20,6
1380 CLS0:PRINT@132,"that word i
s indestructable"
1385 FOR T= 1 TO 1000:NEXT T
1390 GOTO 1070
1400 CLS2:SOUND100,2:CLS4:SOUND2
00,3:CLS6:SOUND255,3:CLS0
1410 PRINT@128,"TERRIFIC !! RID
THE GALAXY OF   MORE MISSPELLED
WORDS"
1420 FOR T=1 TO 1000:NEXT T
1440 IF N=10 THEN 1500
1450 GOTO1000
1499 REM END ROUTINE
1500 CLS0:SOUND50,4:SOUND50,6:SO
UND155,6:CLS4
1510 PRINT@128,H;"SHOTS TO KILL
10 ALIENS !!!!"
1520 PRINT@320,"PLAY AGAIN <Y>/<
N>";
1530 INPUT R$: IF R$="Y" THEN N=
0:H=0:GOTO 1000
1540 END
2000 REM  30 WORDS SPELLED O.K.
2010 DATA ONCE,THREE,TEST,NICE,G
RAY,HAPPY,CITIES,CUTE,HEAVY,EIGH
T
2020 DATA MACHINE,THEIR,AWAKE,RI
DGE,FRIEND,DANCING,COMING,CHAIR,
KEEP,DOZEN
2030 DATA MAGIC,MOVIES,FRIENDLY,
PERCH,HAYLOFT,BUILDINGS,FORESTS,
BABBLING,BANANA,READS
2040 REM 15 MISSPELLED WORDS
2050 DATA DISE,THIER,MASHINE,FRE
IND,JUDJE,DOSEN,FONE,KUTE,KEAP,C
ITYS
2060 DATA READES,WINDOES,LAFFING
,DANSING,HIDD
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From Tetra- To Icosahedron, Let The Good Times Roll!

By Bob Albrecht and
George Firedrake

FANTASY ROLE PLAYING GAMES

Millions of young people, and many not-so-young, are playing fantasy role playing games. A role playing game is a game in which one or more players create and control characters (adventurers) who live their imaginary lives in a specially made game world. The game world is created, managed, and operated by a GameMaster (GM), also called a referee, adventure master, or dungeon master (DM).

Most people who play role playing games use a formal rule system. Some of the best known are shown below.

Dungeons & Dragons (D&D). *From TSR Hobbies, P.O. Box 756, Lake Geneva, WI 53147.*

RuneQuest (RQ). *From Chaosium, P.O. Box 6302, Albany, CA 94706.*
Tunnels & Trolls (T&T). *From Blade, Box 1467, Scottsdale, AZ 85252.*
Worlds of Wonder (WOW). *From Chaosium, P.O. Box 6302, Albany, CA 94706*

BEGINNERS BEWARE! The rule books are very difficult to understand. If you are a beginner, first try ***Worlds of Wonder*** *or* ***Tunnels & Trolls.*** *Programs in "GameMaster's Apprentice" are based on the game system used in* ***Worlds of Wonder*** *and* ***RuneQuest.*** *For general information about fantasy role playing games, try the following book, excellent for beginners.*

Through Dungeons Deep *by Robert Plamondon. From Reston Publishing Company, 11400 Sunset Hills Road, Reston, VA 22090.*

Copyright (C) 1983 by DragonQuest, P.O. Box 310, Menlo Park, CA 94025. Portions of "GameMaster's Apprentice" are from a book-in-progress called ***Adventurer's Handbook: A Beginner's Guide to Role Playing Games.***

(Bob Albrecht and George Firedrake are two of the most prolific authors in the microcomputer world today. Specialists in writing for beginners, they are authors of numerous books, including TRS-80 Color Basic.)

GameMaster's Dice

GameMaster's Dice come in many shapes, from tetrahedrons (four sides) to icosahedrons (20 sides). We assume you are already acquainted with ordinary six-sided dice. We use the abbreviation D6 to mean one six-sided die.

D6 is one six-sided die
1D6 is one six-sided die
2D6 are two six-sided dice
3D6 are three six-sided dice
and so on.



We also use less familiar dice, such as:

D4 

D4 is a tetrahedron, with sides numbered 1 to 4. The number rolled is the one that is right side up after you throw the die.

D8 

D8 is an octahedron, with eight sides numbered 1 to 8.

D12 

D12 is a dodecahedron, with 12 sides numbered 1 to 12.

D20 

D20 is an icosahedron, with 20 sides numbered 1 to 20.



DIGIT DICE

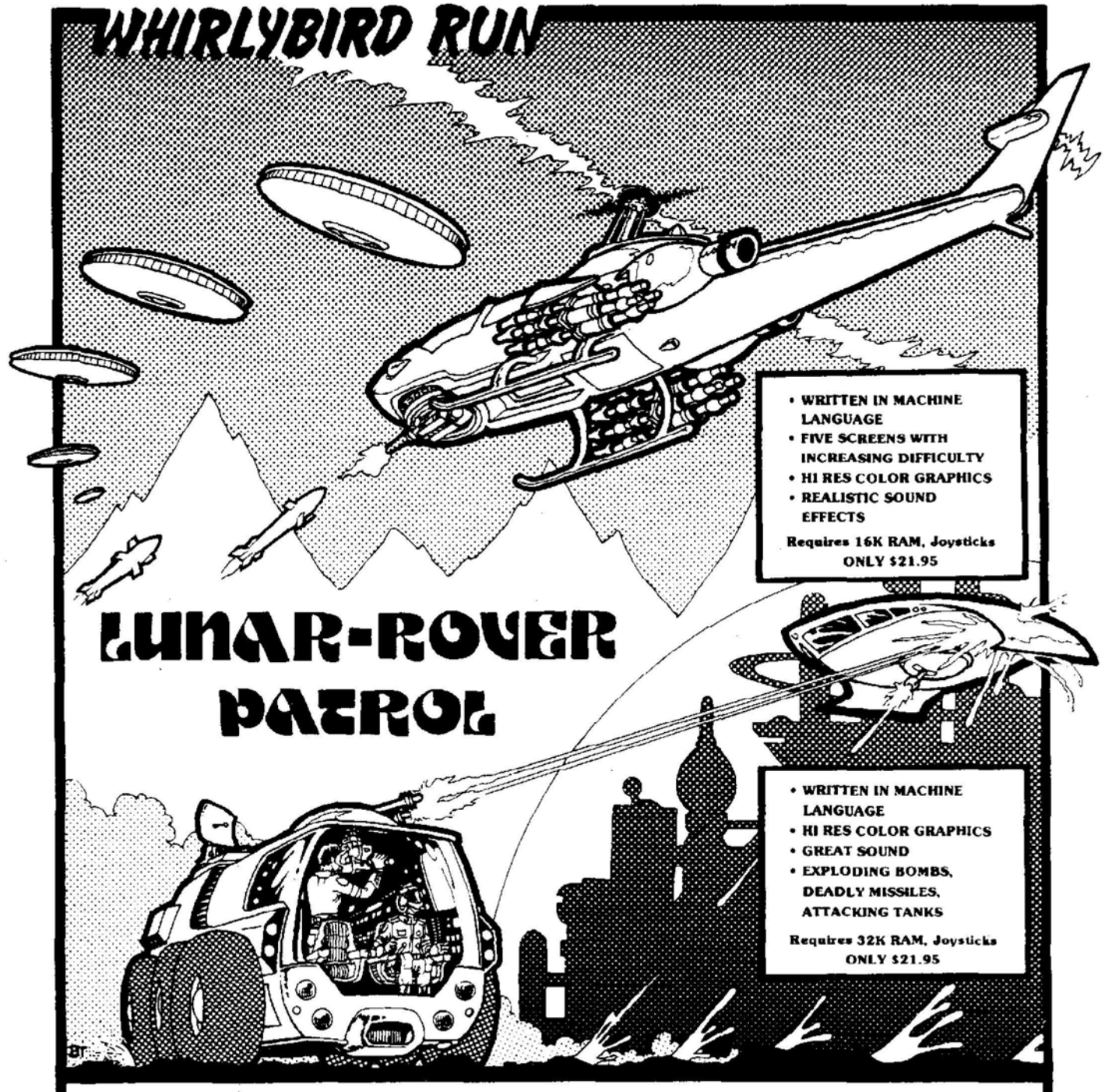
A **digit die (DD)** can be a 10-sided die, with sides numbered 0 to 9, or an icosahedron with 20 sides numbered 0 to 9 (each number appears twice).

We use digit die (DD) to roll a **decimal digit**, 0 to 9. However, sometimes we want to roll D10, a number from 1 to 10. Easy—roll a DD and use 0 to mean 10.

REMEMBER: A digit die (DD) is a 10 or 20-sided die whose faces are numbered 0 to 9.

D100 is a **percentage** roll, also called a **percentile** roll, with numbers from 00 to 99. To make a percentage roll, use a DD (digit die), roll it twice. The first roll is the 10's digit; the second roll is the one's digit. If you roll a 3 the first time and a 7 the second time, the number is 37.

Or use two digit dice of different colors. One color (silver? gold? yellow?) is the 10's digit and the other (white? copper?) is the one's digit.



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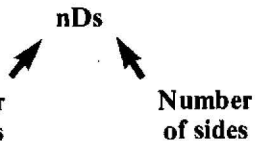
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DEALER INQUIRIES INVITED

We have written a general purpose subroutine to roll n dice, each with s sides.



You can also make a digit die (DD) roll or a percentile (P) roll. Our dice subroutine appears in the following program in lines 13000 through 13260. However, you may change the line numbers, since no line numbers appear in the statements in the subroutine.

```
100 REM**GAMEMASTER'S DICE
110 CLS
120 INPUT "DICE"; DICE$
130 GOSUB 13010
140 PRINT DICE
150 PRINT
160 GOTO 120

13000 REM**DICE SUBROUTINE GMT 1
13010 IF DICE$="" THEN DICE=0: R
ETURN

13020 REM**PERCENTILE OR DIGIT?
13030 IF DICE$="P" THEN DICE=RND
(100)-1: RETURN
13040 IF DICE$="DD" THEN DICE=RN
D(10)-1: RETURN

13050 REM**FIND 'D' IN DICE$
13060 FOR KK=1 TO LEN(DICE$)
13070 : PD = KK
13080 : XX$ = MID$(DICE$, PD, 1)
13090 : IF XX$="D" THEN KK=LEN(D
ICE$)
13100 NEXT KK

13110 REM**NN IS NUMBER OF DICE
13120 IF PD=1 THEN NN=1
13130 IF PD>1 THEN NN=VAL(DICE$)

13140 REM**SS IS NUMBER OF SIDES
13150 LD = LEN(DICE$)
13160 SS$ = RIGHT$(DICE$, LD-PD)
13170 SS =  VAL(SS$)

13180 REM**ROLL THE DICE
13190 DICE = 0
13200 IF NN=0 THEN RETURN
13210 IF SS=0 THEN RETURN
13220 FOR KK=1 TO NN
13230 : DD = RND(SS)
13240 : DICE = DICE + DD
13250 NEXT KK
13260 RETURN
```


SP SOFTWARE

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SPDUMP A screen dump routine of 360 bytes of fast, relocatable machine language code. All PMODES, color PMODES in 4 B&W shades, twice size option in PMODES 3 or 4, position dump on paper, inverse image option, do more than 1 screen as for MPP graphics. Works on DMP200 LPVII etc. Comes with BASIC instructions. Needs BASIC1.1 or an 8bit printer fix. On tape. $16

CONCPOLY Use this menu driven program to design and draw a fantastic variety of intricate and colorful patterns, suitable for dump to a printer. includes examples and instructions. Works in a 16K computer, EXT. or DISK BASIC. Comes on tape. $8

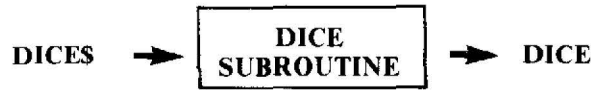
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ROTWORLD This showy program for the 64K computer will display a rotating color globe of the earth. You get 20 frames of a PMODE1 globe which is loaded into 60K of RAM by a driver program plus an instruction program all on disk to show off your 64K color computer. $25

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The subroutine is similar to our *GameMaster's Dice* program in the June issue of *the Rainbow*. Look in that issue for a detailed description of how the program works. Think of the subroutine as a procedure that converts the string DICE$ to the number DICE.



Here is a test run of the subroutine.

```
DICE? 3D6
  13
DICE? 0D6      Zero dice
  0
DICE? 3D0      Zero sides
  0
DICE? DD       Digit Die
  4
DICE? P        Percentile roll
  67
DICE? D
  0
DICE? 1D3
  2
DICE? D5       Same as 1D5
  3
```

DICE? and so on. It seems to work.

If you want to use "D" instead of "DD" to mean "Digit Die," change line 13040.

The Character File

We challenge you to rewrite our latest *CHARACTER FILE* program (July, 1983) so the records are first read into arrays of subscripted variables, as follows:

1st record:

NAYM$(1), STR(1), CON(1), SIZ(1), INQ(1), POW(1), DEX(1), CHA(1)

2nd record:

NAYM$(2), STR(2), CON(2), SIZ(2), INQ(2), POW(2), DEX(2), CHA(2)

and so on.

Our program begins by reserving memory space for string and numeric arrays, then uses a subroutine to read the information into the arays.

```
100 REM**CHARACTER FILE PROGRAM
110 CLEAR 1000
120 DIM NAYM$(50),STR(50),CON(50
),SIZ(50),INQ(50),POW(50),DEX(50
),CHA(50)
130 GOSUB 13010: 'LOAD ARRAYS
```

We reserved space for up to 50 records, including ENDFILE. Here is our subroutine to read the records into the arrays. The information is in DATA statements.

```
13000 REM**LOAD ARRAYS SUBR
13010 RR = 0
13020 RR = RR + 1
13030 READ NAYM$(RR),STR(RR),CON
(RR),SIZ(RR),INQ(RR),POW(RR),DEX
(RR),CHA(RR)
13040 IF NAYM$(RR)="ENDFILE" THE
N RETURN ELSE 13020

30000 REM**CHARACTER RECORDS
30010 DATA ALOYSIOUS, 10, 11, 10
, 12, 10, 12, 9
30020 DATA BAROSTAN, 17, 17, 13,
 8, 7, 15, 6
30030 DATA BRIDLA, 11, 12, 10, 1
5, 6, 11, 16
30040 DATA DERNFARA, 13, 13, 8,
13, 4, 17, 6
30050 DATA JOLEEN, 13, 11, 7, 13
, 8, 17, 13
30060 DATA ROKANA, 9, 9, 9, 17,
18, 9, 10
30070 DATA ENDFILE, 0, 0, 0, 0,
0, 0, 0
```

The menu segment (blocks 200 and 400) is the same as last time. For your convenience, here it is again.

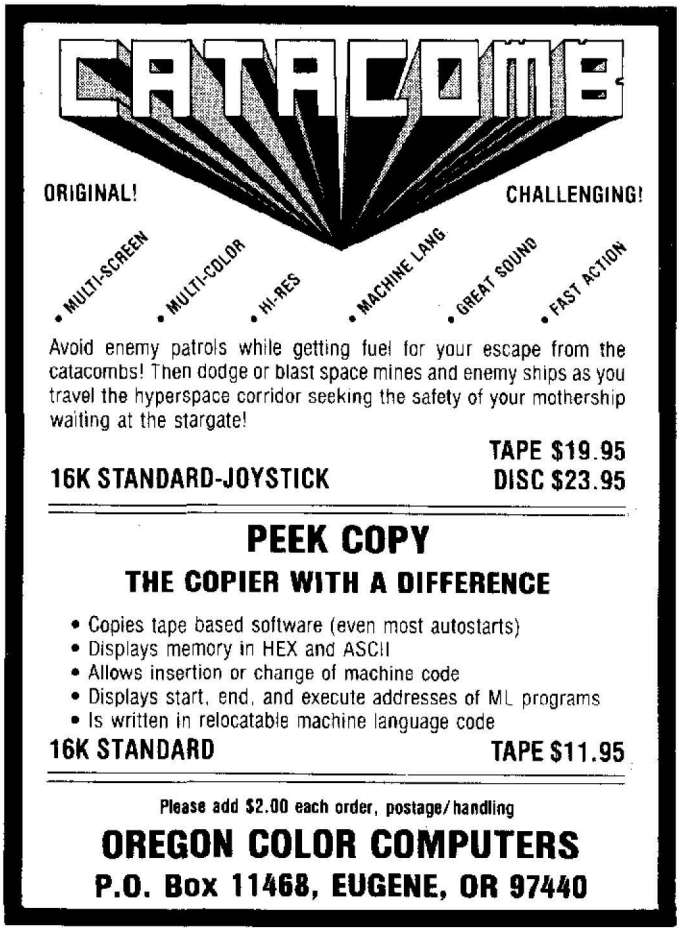
```
200 REM**TELL HOW TO USE
210 CLS
220 PRINT "YOU CAN FIND A CHARAC
TER RECORD"
230 PRINT "BY NAME OF CHARACTER
OR YOU CAN"
240 PRINT "SCAN THE ENTIRE CHARA
CTER FILE."
250 PRINT @128, "MENU:"
260 PRINT @194, "TO FIND A RECOR
D,    PRESS '1'"
270 PRINT @226, "TO SCAN ENTIRE
FILE, PRESS '2'"
280 PRINT @258, "TO RETURN TO ME
NU,   PRESS '0'"
299 :
400 REM**WAIT FOR KEY
410 KEY$ = INKEY$
420 IF KEY$="" THEN 410
430 IF KEY$="1" THEN 1010
440 IF KEY$="2" THEN 2010
450 IF KEY$="0" THEN 210 ELSE 41
0
```

You rewrite the CHARACTER FINDER module beginning at line 1000 and the SCAN CHARACTER FINDER module beginning at line 2000. Remember, the information is now stored in arrays. You may find the READ RECORD SUBROUTINE beginning in line 11000 is no longer necessary. Of course, you must rewrite to PRINT RECORD SUBROUTINE beginning at line 12000 so the information is obtained from the arrays.

Think of other ways to put the character records into the arrays. For example:

- Enter records from the keyboard.
- Load the information from a cassette file.
- Load the information from a disk file.

You can do any of the above by rewriting the LOAD ARRAYS SUBROUTINE.



The Carefully Contrived Character

Instead of asking you to use dice to roll up a character, a GameMaster might give you a certain number of points to "spend" on the seven characteristics.

You may assign 3 to 18 points for any one characteristic, but the total must add up to the number given you by the GM.

We have written a primitive **worksheet** program to help you do this. When you run it, first you see this:

```
1    STR 0
2    CON 0
3    SIZ 0
4    INT 0
5    POW 0
6    DEX 0
7    CHA 0
TOTAL POINTS: 0
CHANGE (1 to 7)?
```

You may now select which characteristic to change by pressing a number key from 1 to 7. CoCo then asks:

NEW VALUE?

Type the new value and press *ENTER*. The new value appears on screen along with a new TOTAL POINTS. You can select a characteristic and enter a new value as many times as you want until you get just the character you want, with exactly the number of TOTAL POINTS the GM said you could have.

Here is our first worksheet program. *Spectaculator* it is not; primitive it is! Perhaps you can improve on it.

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```
100 REM**CONTRIVE A CHARACTER

200 REM**SET UP ARRAYS
210 FOR KK=1 TO 7
220 : READ CH$(KK)
230 : CV(KK) = 0
240 NEXT KK
250 TTL = 0
260 DATA STR,CON,SIZ,INT
270 DATA POW,DEX, CHA

300 REM**PUT WORKSHEET ON SCREEN
310 CLS
320 FOR KK=1 TO 7
330 : PRINT KK,CH$(KK);CV(KK)
340 NEXT KK
350 PRINT
360 PRINT "TOTAL POINTS:" TTL

400 REM**CHANGE WHICH ONE?
410 PRINT
420 PRINT "CHANGE (1 TO 7)?";
430 KEY$ = INKEY$
440 IF KEY$="" THEN 430
450 IF KEY$<"1" THEN 430
460 IF KEY$>"7" THEN 430
470 NC = VAL(KEY$)

500 REM**GET NEW VALUE
510 PRINT: PRINT
520 INPUT "NEW VALUE"; NV
530 CV(NC) = NV

600 REM**COMPUTE NEW TOTAL
610 TTL = 0
620 FOR KK=1 TO 7
630 : TTL = TTL + CV(KK)
640 NEXT KK

700 REM**GO AROUND AGAIN
710 GOTO 310
```

Use the program to contrive a 74 point character; an 80 point character; a 90 point character. For each number of total points, contrive several characters, each different from the others.

Coming Attractions

Surely, but slowly, we will explore the following things:
The elusive *RND*

GameMaster's Dice

Looking up stuff in files. First, files of information in statements and arrays. Next, cassette files. Eventually, disk files.

Whatever else comes to mind or is suggested by you.

What do *you* want? If it fits into the general idea of "GameMaster's Apprentice," we might do it. Send your suggestions, complaints, kudos, requests, whatever . . . to George & Bob, P.O. 310, Menlo Park, CA 94025.

READ THE FINE PRINT.
It's worth your time. This is good stuff.

SYSTEMS SOFTWARE

MACRO-80C

This is a **disk-based editor, macro assembler and monitor,** written for Color Computer by Andy Phelps. THIS IS IT — The ultimate programming tool!

The powerful 2-pass macro assembler features conditional assembly, local labels, include files and cross referenced symbol tables. MACRO-80C supports the complete Motorola 6809 instruction set in standard source format. There are no changes, constraints or shortcuts in the source language definition. Incorporating all of the features of our Rompack-based assembler (SDS80C), MACRO-80C contains many more useful instructions and pseudo-ops which aid the programmer and add power and flexibility.

The screen-oriented text editor is designed for efficient and easy editing of assembly language programs. The "Help Key" feature makes it simple and fun to learn to use the editor. As the editor requires no line numbers, you can use the arrow keys to position the cursor anywhere in the file. MACRO-80C allows global changes and moving/copying blocks of text. You can edit lines of assembly source which are longer than 32 characters.

DCBUG is a machine language monitor which allows examining and altering of memory, setting break points, etc.

The editor, assembler and monitor — as well as sample programs — come on one Radio Shack compatible disk. Extensive documentation included. **MACRO-80C Price: $99.95**

SOFTWARE DEVELOPMENT SYSTEM

The Micro Works Software Development System (SDS80C) is a complete 6809 editor, assembler and monitor package contained in one Color Computer program pack! Vastly superior to RAM-based assemblers/editors, the SDS80C is non-volatile, meaning that if your application program bombs, it can't destroy your editor/assembler. Plus it leaves almost all of 16K or 32K RAM free for **your** program. Since all three programs, editor, assembler and monitor are co-resident, we eliminate tedious program loading when going back and forth from editing to assembly and debugging!

The powerful screen-oriented Editor features finds, changes, moves, copys and much more. All keys have convenient auto repeat (typamatic), and since no line numbers are required, the full width of the screen may be used to generate well commented code.

The Assembler features **all** of the following: complete 6809 instruction set; conditional assembly; local labels; assembly to cassette tape or to memory; listing to screen or printer; and mnemonic error codes instead of numbers.

The versatile monitor is tailored for debugging programs generated by the Assembler and Editor. It features examine/change of memory or registers, cassette load and save, breakpoints and more. **SDS80C Price: $89.95**

MICRO WORKS COLOR FORTH

- Forth is faster to program in than Basic
- Forth is easier to learn than Assembly Language
- Forth executes in less time than Basic

Forth is a highly interactive language like Basic, with structure like Pascal and execution speed close to that of Assembly Language. The Micro Works Color Forth is a Rompack containing everything you need to run Forth on your Color Computer.

Color Forth consists of the standard FORTH Interest Group (FIG) implementation of the language plus most of FORTH-79. It has a super screen editor with split screen display. Mass storage is on cassette. Color Forth also contains a decompiler and other aids for learning the inner workings of this fascinating language. It will run on 4K, 16K, and 32K computers. Color Forth contains 10K of ROM, leaving *your* RAM for *your* programs! There are simple words to effectively use the Hi-Res Color Computer graphics, joysticks, and sound. The 112-page manual includes a glossary of the system-specific words, a full standard FIG glossary and complete source listing. COLOR FORTH ... THE BEST! From the leader in Forth, Talbot Microsystems. **Price: $109.95**

MICROTEXT: COMMUNICATIONS VIA YOUR MODEM!

Make your Color Computer an intelligent printing terminal with off-line storage! The Microtext module is just what you'll need for:

- Talking to a timeshare system or information service
- Printing out what is received as it is received
- Saving received text to cassette tape
- Re-displaying the received text even while on-line
- Communications with other computers
- Using your computer as a general-purpose 300-baud terminal
- Downloading programs from other computers

The Microtext module is a program pack containing not only firmware but a second serial port so that both your printer and modem can be connected at the same time. Microtext can be configured for any serial printer that will work with the Color Computer, even if it requires line feeds! But even if you don't have a printer, you can keep a permanent copy of your data by storing to cassette tape. Also, any Radio Shack/Centronics-compatible parallel printer may be used by adding the Micro Works' PI80C parallel interface.

For those of you with special terminal applications, Microtext has selectable parity; it sends odd, even, mark or space. With mark parity (which is default) you can send to computers requiring either seven or eight bits. All 128 ASCII codes can be sent. Exchange programs with other Color Computer users! Basic programs may be downloaded from other computers or timesharing systems.

You'll find many uses for this versatile module! Available in ROMPACK, ready-to-use, for **$59.95.**

MACHINE LANGUAGE

MONITOR TAPE: A cassette tape which allows you to directly access memory, I/O and registers with a formatted hex display. Great for machine language programming, debugging and learning. It can also send/receive RS232 at up to 9600 baud, including host system download/upload. 19 commands in all. Relocatable and reentrant. **CBUG Tape Price: $29.95**

MONITOR ROM: The same program as above, supplied in 2716 EPROM. This allows you to use the entire RAM space. And you don't need to re-load the monitor each time you use it. The EPROM plugs into the Extended Basic ROM Socket or the Romless Pak I. **CBUG ROM Price: $39.95**

SOURCE GENERATOR: This package is a disassembler which runs on the color computer and generates your own source listing of the BASIC interpreter ROM. Also included is a documentation package which gives useful ROM entry points, complete memory map, I/O hardware details and more. A 16K system is required for the use of this cassette. **80C Disassembler Price: $49.95**

BOOKS

6809 Assembly Language Programming, by Lance Leventhal, **$16.95**

TRS-80 Color Computer Graphics, by Don Inman, **$14.95**

Assembly Language Graphics for the TRS-80 Color Computer, by Don Inman, **$14.95**

Starting Forth, by L. Brodie, **$19.95**

GAMES

Star Blaster — Blast your way through an asteroid field in this action-packed Hi-Res graphics game. Available in ROMPACK; requires 16K. **Price: $39.95**

Pac Attack — Try your hand at this challenging game by Computerware, with fantastic graphics, sound and action! Cassette requires 16K. **Price: $24.95**

Haywire — Have fun zapping robots with this Hi-Res game by Mark Data Products. Cassette requires 16K. **$24.95**

Dunkey Munkey — Arcade excitement awaits those who dare to conquer the Munkey! Joystick and 32K required, by Intellectronics. Cassette: **$24.95**

Colorpede — Great graphics, two-player option, and pause control in this exciting game by Intracolor Communication. Cassette requires 16K: **$29.95**

Adventure — *Black Sanctum* and *Calixto Island* by Mark Data Products. Each cassette requires 16K: **$19.95** each.

Cave Hunter — Experience vivid colors, bizarre sounds and eerie creatures in hot pursuit as you wind your way through a cave maze in search of gold treasures. This exciting Hi-Res game by Mark Data Products requires 16K for cassette version. **$24.95**

Starfire — Fly around the planet defending Earthlings from being snatched up by aliens in this challenging game from Intellectronics. Cassette requires 16K: **$21.95**

Doodle Bug — Joystick-controlled Doodle Bugs must move quickly through mazes while being chased by enemy bugs in Hi-Res game by Computerware. Cassette requires 16K: **$24.95**

Astro Blast — You'll need to act fast as you protect Earth from wave after wave of alien invaders in this Hi-Res game by Mark Data. Cassette requires 16K: **$24.95**

HARDWARE

PARALLEL PRINTER INTERFACE — Serial to parallel converter allows use of all standard parallel printers. PI80C plugs into the serial output port, leaving your Rompack slot free. You supply the printer cable. **PI80C Price: $69.95**

MEMORY UPGRADE KITS: Consisting of 4116 200ns., integrated circuits, with instructions for installation. **4K-16K Kit Price: $39.95. 16K-32K Kit** (requires soldering experience) **Price: $39.95.** For Rev. level E, ET, NC and TDP-100s, we carry 64K chips; upgrading is easy! Eight prime **64K chips** and instructions: **$64.95**

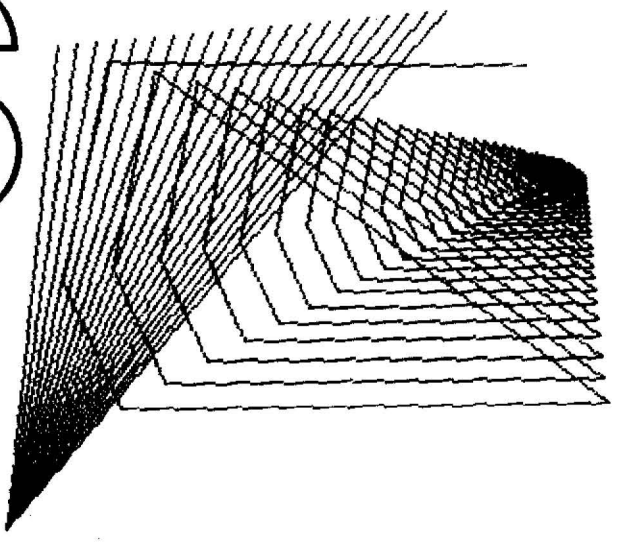
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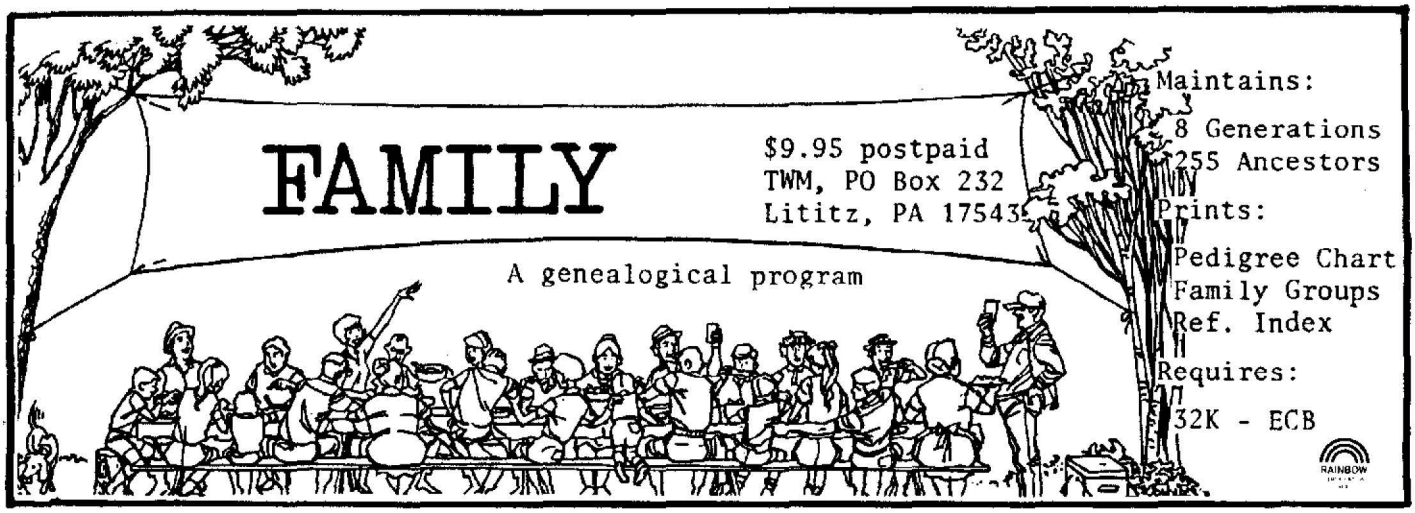
By Walter Seay

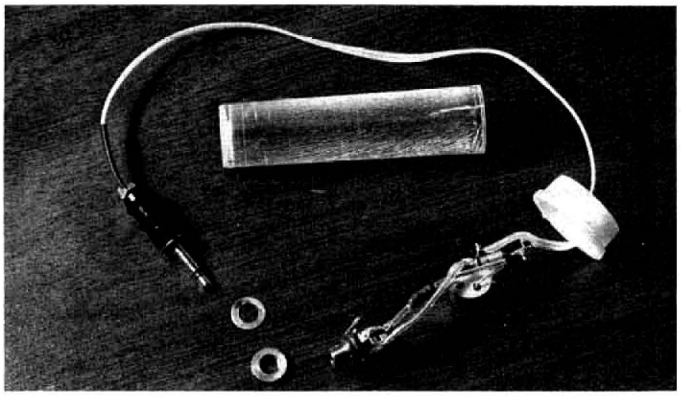
The following graphics program, *Lines*, generates a series of lines that form new designs with each new screen.

Simply *CLOAD* and *RUN* the program. The listing is short, so beginners will enjoy giving this program a try. And, by changing the values in lines 20-50 you can give each screen a new look.

The listing:

```
0 '**************************
1 '**                      **
2 '**        LINES         **
3 '**   MARCH 31, 1983     **
4 '**                      **
5 '**    WALTER SEAY       **
6 '**                      **
7 '**************************
10 PCLEAR8
20 PMODE4,1:SCREEN1,1:PCLS
30 A=40:B=0
40 LINE(A,10)-(B,188),PSET
50 A=A+8:B=B*2
60 IF A>200 THEN 90
70 GOTO 40
80 REM
90 PMODE4,5:PCLS
100 FORP=1TO4:PCOPY P TO P+4:NEX
TP:SCREEN1,1
110 R=RND(7)
120 FORI=1TOR:X(I)=RND(255):Y(I)
=RND(188):NEXTI
130 X=RND(255):Y=RND(188)
140 PSET(X,Y,C)
150 FORJ=1TO30:FORI=1TOR
160 LINE-(X(I),Y(I)),PSET
170 X(I)=(X(I)-X)*.9+X
180 Y(I)=(Y(I)-Y)*.9+Y
190 NEXTI:NEXTJ
200 FORW=1TO480:NEXTW
210 GOTO100
```





End Those Sticky Relay Blues

By Barry E. Becker

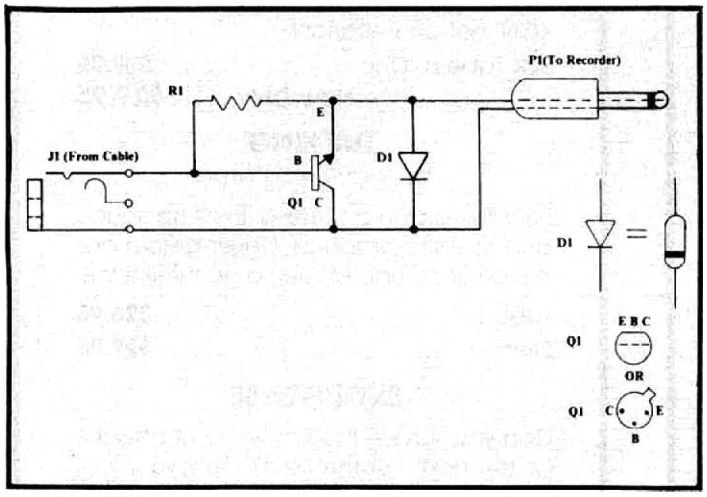
Have you ever loaded a program from cassette and found the tape recorder still running after it should have stopped? Or worse, have you ever been using a program that stored files to tape, and found that the tape ran right to the end while you were thinking about something else? Under such a circumstance, I once invented three new curse words never before heard by man or woman.

The problem is caused by a sticking recorder relay in the Color Computer, and it is apparently not an unusual problem.

A technical type person at a local Radio Shack Computer Center suggested that the current flowing through the contacts creates enough of a magnetic field to hold the reed relay closed, even when the relay coil current is interrupted. The higher the current, the greater the chance of a problem.

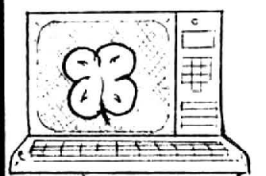
The problem can be solved by reducing the current in the contacts. I have a Panasonic recorder, not a CTR-80, but I suspect the electrical polarities are the same, since the circuit shown here worked with three different brands of recorders (including my son's "portable" lift-it-if-you-can blaster box).

The circuit requires only a few dollars worth of parts, and can be stuffed into a small plastic pill bottle. The circuit is shown in Figure 1. The transistor, type 2N2222 or equivalent acts as a switch and passes the motor current, instead of the relay passing it. The relay contacts now pass only the transistor base current, about 100 times less than the motor current. The resistor prevents any small leakage current from turning on the transistor, and the diode clips any voltage spikes that might appear when the motor current is interrupted.



All of the parts may be purchased at Radio Shack as follows:

Symbol	Radio Shack P/N	Description
Q1	276-2009	Transistor, 2N2222 equivalent
D1	271-1122	Diode, 1N914
R1	271-1339	Resistor, 22K ohms
P1	274-289	Sub-mini phone plug
J1	274-292	Sub-mini phone jack



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HOME POWER CONTROL—Part IV

Keep Your Home On Schedule

By A. B. Trevor

Your lights, appliances, water sprinkler valves—in fact, anything electrically activated—can be controlled by your Color Computer, a Plug 'n Power Controller, and the *HOMRUN* program (Listing 1). This program lets you schedule a week at a time when electrical switches are to be turned on, off, dimmed or brightened. You can save these schedules on disk for future use or modify them with the built in editor. Each day's events are displayed by a color bar graph, along with the current day and time.

The previous articles in the Home Control series presented the Plug 'n Power hardware, a simple control program, a real time clock, and a description of the BSR X10 signaling protocol. This last article in the series utilizes all these concepts in the *HOMRUN* program.

ML Overlay

Although *HOMRUN* is written primarily in BASIC, it requires machine language routines for the real time clock and BSR pulse generation. These routines must be in a disk file named *X10CLK.BIN*, which is generated by *X10CLK.BAS* (Listing 2). Note that the data statements in *X10CLK* contain the same machine language as appeared in the first two articles. Lines 200-490 in Listing 2 (the clock routines) correspond to lines 270-710 on page 22 of *the Rainbow*, April, 1983, while lines 500-570 (X10 routine) incorporate lines 390-500 on page 163 of the February, 1983 issue. If you don't have access to CompuServe or Rainbow on Tape and have already typed in the earlier programs, you can save some time by renumbering and merging the data statements from these earlier programs. (One fix is required: the 39 in line 340 of PNPCLK should be changed to 43.)

After loading *X10CLK*, place a diskette containing *HOMRUN.BAS* in drive 0 and run *X10CLK.BAS* once. This will write *X10CLK.BIN* on the disk with *HOMRUN*. Once this has been done, you can delete *C10CLK.BAS*.

Before attempting to load or run *HOMRUN*, 16K users must type *PCLEAR 1*.

(Alexander Trevor is Executive Vice President of computer resources at CompuServe.)

HOMRUN Commands

Your Plug 'n Power controller must be connected to the cassette port and switched to "CTRL" before running *HOMRUN*. If it is not, the warning "BSR is OFF" will appear on the screen until the condition is remedied. Initially, *HOMRUN* will display the help page, which lists the single letter commands. These may be typed whenever the "COMMAND:" prompt appears on the screen:

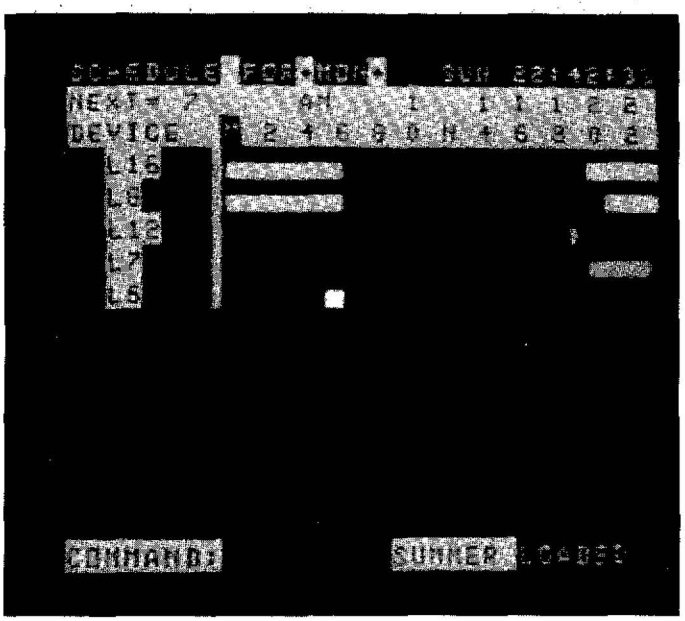
- I Insert an event. You must supply the day, time, device and unit codes (e.g., G3), and action. Action codes are: ON, OFF, CLR, ALL, DIMn and BRn.
- D Detail event editor. Lists events 12 at a time. You can delete an event (D), cause it to be the next one to be executed (E), or just move on to the next event *(ENTER)*. The next scheduled event is marked ">" in column 1.
- L Loads a schedule file from disk.
- S Saves the current schedule to a disk file.
- H Types the Help text.
- C Set the Clock.
- V View the schedule for the next day in sequence.
- @ Send a device command immediately.

When a day is requested, at least two letters of the day of the week must be given (e.g., SU, MO, FR). You may also reply "ALL," in which case an event will be generated at the same time every day. Even if you wish an event to occur only four or five days a week, it is quicker to insert the event for "ALL" days, then delete the unwanted days with the "Detail" command. Time must always be entered military fashion (e.g., 23:00) since *HOMRUN* does not use a.m. and p.m.

To reduce the number of events (there is space for only 60 as configured here) consider using the *ALL* and *CLR* commands. Both act on all devices on the given house code; a unit code must be supplied but is ignored in this case. Since the *HOMRUN* program controls all 16 house codes at once, you may be able to use this feature to your advantage.

When you enter several events as you create your electronic home schedule, it is not obvious which event is the one

that should be executed next. *HOMRUN* assumes that the first chronological event (first event after 00:00 Sunday) is the next event for keyboard entered schedules, but this may not be what you want. For example, on Monday you may enter a schedule that includes an event on Sunday and one on Wednesday. *HOMRUN* will wait for the Sunday event, because from its point of view, that is the earliest event. For this reason, you should always review a schedule with the "DETAIL" command to set the desired next event. In the case of schedules loaded from disk, the scheduler is left OFF until you specify the next event.



Schedule Screen

Upon completion of any command, a screen of a day's events will be drawn. This screen is intended to give a rough idea of the state of up to 12 different devices during a day. (You can control more devices, but only the first 12 will be displayed on the screen.) Initially the current day will be displayed, but you can display future days in sequence one at a time with the "View" command. Since the events of one day may affect the next day (e.g., a light turned on yesterday remains on until it is turned off), it is not possible to skip days in the display cycle.

The event screen displays the actual day and time in the upper right corner. The day being displayed is indicated in the center of the first line, as "SCHEDULE FOR *MON*." The second line reveals the next event to be executed by event number. You will have to review the list of events with the "Detail" command to determine the particulars on this event. Time of day, starting at M (midnight) and extending through N (noon) to the next midnight, labels the horizontal axis in two hour increments on lines 2 and 3. Devices (consisting of a single letter house code and one or two digit device code) label the vertical axis.

Horizontal bars are drawn to indicate the hours that a device is to be activated. The bars are white if the device was last turned ON, blue if it was DIMmed, and orange if it was BRightened. Black indicates the device is off. Resolution is one-half hour.

The bottom line will contain the prompt "COMMAND:" when *HOMRUN* is ready to accept another command. Typing before this prompt appears will be ignored. Finally, if you load or save a disk schedule, the name of the schedule will be shown in the lower right corner.

One warning: although the event screens are nice to look at, *HOMRUN* will work just fine with your TV off—and your screen won't get engraved with an image of your schedule.

Modifications

As supplied, *HOMRUN* is limited to 60 events. This may be expanded by changing the value of NE in line 120, but any significant change will require 32K. To create a 32K version, the ML routines must be relocated. This can be done by changing &H3D00 to &H7D00 in line 20 of *X10CLK.BAS* and line 2915 of *HOMRUN*. *X10CLK.BAS* must be rerun to write the 32K version of *X10CLK.BIN*.

Although it is not nearly as convenient as the disk version, *HOMRUN* may be converted to cassette by changing the value of DV in line 110 to -1. The main problem cassette users will have is remembering to switch the controller from "CTRL" to "CASS" at the appropriate times.

Both programs are again available on CompuServe's ACCESS data base, and may be downloaded with *VIDTEX* or other terminal software to your machine. They are stored as *X10CLK*.CC[70000,130] and *HOMRUN* [70000,130]. I may be contacted via *EMAIL* at 70000,130, or on the Color SIG.

```
220.....0275
560.... 050E
910.....0836
1200... 0B6B
1480... 0E38
1840... 11DF
2190... 150F
2580... 181A
END... 1B93
```

Listing 1:

```
10 '*******************************
20 '              HOMRUN
30 '7 DAY SCHEDULING PROGRAM FOR
40 '  PLUG'N POWER CONTROLLER
50 ' (C) A. B. Trevor,  Apr 1983
60 '*******************************
70 '
80 GOTO 2915
100 'USER SETTABLE PARAMETERS
110 DV=1:'       -1 FOR CASSETTE
120 NE=60:'    MAX NUMBER EVENTS
130 DT=12:'     DEVICE TBL SIZE
140 ML=PEEK(39)*256+PEEK(40)+1
150 '    **END OF PARAMETERS**
160 DIM EVNT(6,NE)   :'EVENT ARRA
170 DIM BTAB(16)     :'BSR DIGITS
180 DIM AD$(DT)      :'DEV NAMES
190 DIM ADN(DT)      :'DEV#
200 DIM LST(DT)      :'LAST STATE
210 DIM HUE(6)       :'CMD COLORS
220 DATA 6,E,2,A,1,9,5,D,7,F,3,B
,0,8,4,C
230 DATA 0,5,5,0,3,8
240 '
250 CLS 1
```

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```
260 'LOAD BSR TABLE AND COLORS
270 FOR I=1 TO 16: READ A$: BTAB
(I)=VAL("&H"+A$): NEXT I
300 FOR I=0 TO 5: READ HUE(I):
NEXT I
350 'LOAD BSR ROUTINES
360 DEFUSR0=ML  : DEFUSR1=ML+3
370 DEFUSR2=ML+6: DEFUSR3=ML+9
400 IF PEEK(ML+12)=&H4F AND PEEK
(ML+13)=&H6A THEN DAY=USR0(-1)+1
:X=USR1(-1): GOTO 480
410 PRINT"LOADING M/L"
420 IF DV=-1 THEN CLOADM"X10CLK"
 ELSE LOADM"X10CLK"
430 '
440 'SET THE CLOCK
450 GOSUB 2580
460 X=USR0(DAY-1)
470 X=USR1(HR*256+MIN)
480 EC=0:' INITIALLY NO EVENTS
490 GOTO 2300
500 '
510 'MAIN CONTROL LOOP
520 ' DISPLAY ONE DAY'S SCHEDULE
530 CLS 0
540 DW$=MID$("sunmontuewedthufri
sat",DAY*3-2,3)
550 PRINT@0,"schedule for*";DW$;
"*";
560 PRINT@32,"              AM
1   1 1 1 2 2 ";
570 PRINT@64,"DEVICE  m 2 4 6 8
0 N 4 6 8 0 2 ";
580 IF NX=0 THEN PRINT@32,">OFF<
"; ELSE PRINT@32,"NEXT=";NX;
590 IF FLNM$<>"" THEN PRINT@497,
FLNM$;" loaded";
600 ' DISPLAY DEVICE CODE
610 FOR DI=1 TO DN
620 IF ADN(DI)=0 THEN 670
630 PRINT@DI*32+66,AD$(DI);
640 SET(15,DI*2+4,1)
650 SET(15,DI*2+5,1)
660 NEXT DI
670 'DISPLAY PREV DAY'S STATE
680 IF NOT NDQ THEN 760
690 TH=0: TM=0: NDQ=0
700 FOR DI=1 TO DN
710 IF ADN(DI)=0 THEN 760
720 LC=LST(DI)
730 IF LC>0 AND LC<>30 THEN GOSU
B 2710
740 NEXT DI
750 ' SCAN EVERY EVENT
760 FOR I=1 TO EC
770 IF EVNT(0,I)<>DAY THEN 900
780 '   LOOK FOR THIS DEVICE
790 TA=EVNT(2,I)*16+EVNT(3,I)-1
800 LET DI=1
810 IF ADN(DI)=TA THEN 840
820 DI=DI+1: IF DI<=DN THEN 810
830 GOTO 900:' WHEN DISPLAY FULL
840 LC=EVNT(4,I)
850 'DISPLAY DEVICE STATE
860 IF LC<20 THEN FOR DI=1 TO DN
870 GOSUB 2690
880 LST(DI)=LC
890 IF LC<20 THEN NEXT DI
900 NEXT I  :'END OF EVENT GRAPH
910 '
920 PRINT@480,"COMMAND:";
930 IF EC=0 THEN HR=25:GOTO 980
940 'GET TIME TO NEXT EVENT**
950 HR=FIX(EVNT(1,NX)/100)
960 MIN=EVNT(1,NX)-HR*100
970 'WAIT FOR EVENT OR KEY
980 A=USR2(HR*256+MIN)
990 IF A=-1 THEN PRINT@480,"BSR
OFF!";: SOUND 1,20: GOTO 920
1000 IF A>0 THEN 1190
1010 IF EVNT(0,NX)<>USR0(-1)+1 T
HEN 920
1020 IF NX=0 THEN 940
1030 'SEND EVENT TO CONTROLLER
1040 HC=BTAB(EVNT(2,NX))*16
1050 A=768+HC+BTAB(EVNT(3,NX))
1060 X=USR3(A): CD=EVNT(4,NX)
1080 IF CD>30 THEN RP=2*(CD-FIX(
CD/10)*10)+1 ELSE RP=3
1090 A=RP*256+HC+FIX(CD/10)+&H40
00
1100 X=USR3(A)
1110 SOUND 150,3:SOUND 100,3
1120 IF NX<EC THEN NX=NX+1 ELSE
NX=1
1125 PRINT@37,NX;
1130 'WAIT TILL NEXT MINUTE
1140 MIN=MIN+1: IF MIN>59 THEN M
IN=0: HR=HR+1
1150 IF HR<24 THEN GOSUB 1180: I
F A>0 THEN 1190 ELSE 940
1160 HR=0: DAY=DAY+1: IF DAY>7 T
HEN DAY=1
1170 GOSUB 1180: IF A>0 THEN 119
0 ELSE 520
1180 A=USR2(HR*256+MIN): RETURN
1190 'PROCESS KEYBOARD COMMANDS
1200 IF A=3 THEN END
1210 CD=INSTR(1,"IDLSH@CV",CHR$(
A))
1220 IF CD=0 THEN PRINT@488,"?";
:SOUND 1,2:GOTO940
1230 CD=CD-1
1240 '            INSERT DEL  LOAD
 SAVE HELP IMMD CLCK VIEW
1250 ON CD+1 GOTO 1270,1680,2010
,2150,2290,2430,2530,1640
1260 '
1270 'INSERT COMMAND
1280 IF EC=NE THEN PRINT@490,"FU
```

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```
LL";: GOTO 600
1290 CLS 1:PRINT"<INSERT EVENT>"
1300 GOSUB 2580:'GET TIME
1320 GOSUB 2780:' GET COMMAND
1330 IF DAY=8 THEN ALS=-1 ELSE A
LS=0
1340 IF ALS THEN FOR DAY=1 TO 7
1350 EC=EC+1
1360 '  LOOK FOR TIME LATER THAN
 REQUEST
1370 FOR I=1 TO EC-1
1380 IF(EVNT(0,I)>DAY) OR ((EVNT
(0,I)=DAY) AND (EVNT(1,I)>(HR*10
0+MIN))) THEN 1410
1390 NEXT I
1400 I=EC:   GOTO 1460
1410 '  MAKE HOLE FOR EVENT
1420 FOR J=EC-1 TO I STEP -1
1430 FOR K=0 TO 5
1440 EVNT(K,J+1)=EVNT(K,J)
1450 NEXT K,J
1460 EVNT(0,I)=DAY
1470 EVNT(1,I)=HR*100+MIN
1480 EVNT(2,I)=HC
1490 EVNT(3,I)=UN
1500 EVNT(4,I)=CX*10+CB
1520 'ADD TO DEVICE TABLE IF NEW
1530 FOR I=1 TO DN
```


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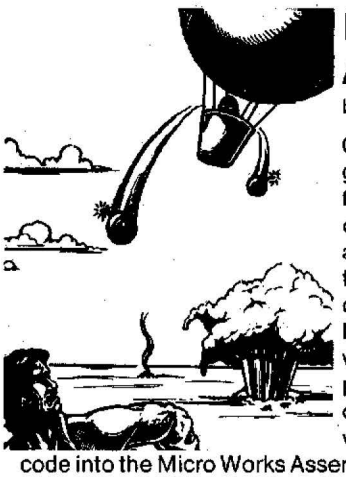
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```
1540 IF ADN(I)=HC*16+UN-1 THEN 1
610
1550 NEXT I
1560 IF DN=DT THEN PRINT"DISPLAY
 FULL":SOUND 201,30:GOTO 1610
1570 DN=DN+1
1580 ADN(DN)=HC*16+UN-1
1590 AD$(DN)=B$
1600 IF NX=0 THEN NX=1
1610 IF ALS THEN NEXT DAY
1620 IF DAY>7THEN DAY=USR0(-1)+1
1630 GOTO 520
1640 'NEXT DAY'S GRAPH
1650 IF DAY>=7 THEN DAY=1 ELSE D
AY=DAY+1
1660 NDQ=-1
1670 GOTO520
1680 'DETAIL EVENT LISTER/EDITOR
1690 IF EC=0 THEN PRINT@490,"?EM
PTY";:SOUND 1,2:GOTO 940
1695 FOR L=1 TO EC STEP 12
1700 CLS 1:PRINT"<DETAIL EVENTS>
"
1710 PRINT"dELETE, eXEC NEXT, OR
 <ENTER>"
1720 PRINT" day  time device cod
e"
1730 K=0
1740 FOR J=1 TO 2
1750 PRINT@94," "
1755 IF L+11>EC THEN LM=EC ELSE
LM=L+11
1760 FOR I=L TO LM
1770 IF EVNT(0,I)=0 THEN 1910
1780 DW$=MID$("SUNMONTUEWEDTHUFR
ISAT",EVNT(0,I)*3-2,3)
1790 DC$=CHR$(EVNT(2,I)+64)+RIGH
T$(STR$(EVNT(3,I)),2)
1800 CX=FIX(EVNT(4,I)/10)
1810 CC$=MID$("CLRALLON OFFDIMBR
 ",CX*3+1,3)
1820 CB=EVNT(4,I)-CX*10
1830 IF NX=I THEN A$=">" ELSE A$
=" "
1840 PRINT A$;DW$;" ";EVNT(1,I);
" ";DC$;"   ";CC$;
1850 IF CX>3 THEN PRINT CB;"  ";
ELSE PRINT"   ";
1860 IF J=1 THEN PRINT: GOTO1910
1870 INPUT A$
1880 A$=LEFT$(A$,1)
1885 IF A$<>"E" THEN 1910
1890 IF A$="D" THEN EVNT(0,I)=0
1900 IF NX>=L AND NX<L+12 THEN P
RINT@32*(NX-L+3)," ";
1905 NX=I: PRINT@32*(I-L+3),">";
: PRINT@32*(I-L+4),"";
1910 NEXT I,J,L
1920 FOR I=1 TO EC:' COMPRESS
1930 IF I=NX THEN NX=I-K
```

- COMPUTER SHACK -



BALLOON ATTACK

by Tim Purves

Computer Shack's first color game is something totally different from the normal. It is not only a great game with plenty of action and adventure, but within the Balloon package, we are offering you an exceptional learning tool. The game comes with a complete commented printout of the entire source code. In fact if you buy the disk version you could load the source code into the Micro Works Assembler and reassemble portions of it yourself.

The game is written in the Hi Res P mode 3, contains routines showing sound, hi res graphics, excellent color, Joy stick commands, interrupt handling and much more.

Available either on Disk or Tape for the TRS-80 Color Computer. With the commented, machine language, source code you will have a chance to see, step by step, exactly how the game was written and executed. Take advantage of this new concept to improve your programming skills. For those just learning machine language, or even experts who are looking for new and helpful tips.

The game is about a mad bomber flying in his red balloon, dropping bombs on unweary pedestrians. You can run and dodge the bombs, but to no avail he'll eventually get you, its just a matter of time!!

The game is available from you favorite dealer or directly from COMPUTER SHACK, 1691 Eason, Pontiac, Michigan 48054, (313) 673-2224.

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new ASCII transmit and receive mode. Now you can transfer files and talk to people who don't have DFT.

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CIII

by Tim Purves

You can finally use your Radio Shack Color Computer disk's in a Model I, Model III, or even a Model IV system. From Computer Shack, the development of a fantastic new software break through has been brought about. CIII (pronounced c3), a simple software package that makes Color Computer disks compatible with other TRS-80's. Now you can copy programs and data files from machine to machine with no messy conversions or troublesome retyping.

Much like a VFU utility, simple insert your Color Disk in any 2 drive model I, III, or IV system and select the files you wish to transfer. It's that easy! And think of the uses. Word Processor files, Basic programs, Machine language, and much more can be copied from a Model I/III disk to or from your Color Computer disk in a matter of seconds. CIII, from now on life is gonna be a lot easier!!! Compatible with most Model I/III operating systems.

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14. **MS GOBBLER** ..... Spectral
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NOTE: Due to the fact we can not obtain tape versions of Zaxxon some of the members of the panel have not seen it. Lancer and Whirly Bird Run likewise have not been evaluated by the panel. Even though these products had been advertised for two for three months they were not available.



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"THE FROG"

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ARCADE ACTION
This one will give you hours of exciting play... Cross the busy highway to the safety of the median and rest awhile before you set out across thes swollen river teaming with hidden hazards. Outstanding sound and graphics.

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NEW

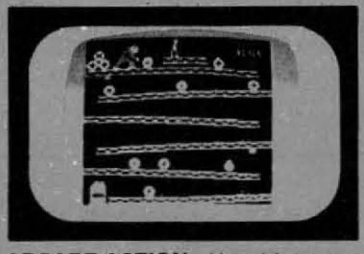
SPACE SHUTTLE

$28.95 TAPE ONLY

1983
32K Ext. Basic



This program gives you the real feeling of flight. Full instrumentation complete to the max. Actual simulation of space flight. **32K Ext. Basic**



THE KING

1982
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ARCADE ACTION - How high can you climb? Four full graphic screens. Exciting Sound - Realistic graphics. Never before has the color computer seen a game like this. Early reviews say: Just like the arcade - Simply outstanding!

NEW

"TRAPFALL"

By KEN KALISH
(C) 1983



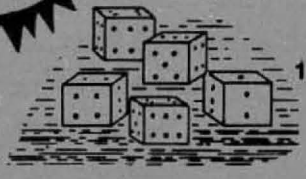
ARCADE ACTION
The "Pitfalls" in this game are many. Hidden treasures, jump over the pits, swing on the vine, watch out for alligators, beware of the scorpion. Another game for the Color Computer with the same high resolution graphics as "The King."

16K MACHINE LANGUAGE
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NEW

"YAAZEE"

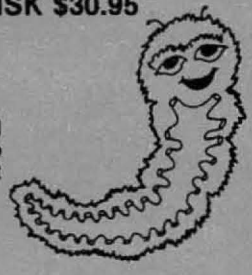
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16K MACHINE LANGUAGE
EXT. BASIC

Yaazee is a 2 player game using five dice to get the best poker hand. After game is loaded flashing digit below player number determines which player rolls dice at the start of the game.

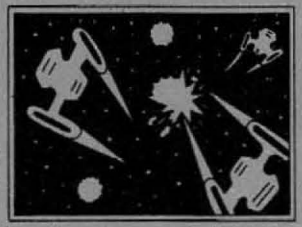
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SCREEN PRINT ROUTINE-Using your Epson or Microline Printer. Print the screen contents on a full size 8½ x 11 sheet. 16K Ext. Basic **$17.95**

TAPE DUPE Now — an all new Tape Backup Program. Even copies those hard to copy Auto-Execute Programs. Protect your software by making a backup copy. Probably the finest tape copier program ever. 16K Maching Language. **TAPE $21.95 DISK $25.95**

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TAPE CAT-All new machine language program lists contents of tapes to printer. Make a catalog of your tapes. **$17.95**

PROGRAM PRINTER UTILITY-This program will list basic programs to your printer in two column format. Saves paper and makes your listing look professional. Disk based. **$17.95**

NEW

EDUCATIONAL SOFTWARE For The Color Computer and TDP 100

STORY PROBLEMS is a program that is designed to give practice in solving STORY PROBLEMS (sometimes called STATEMENT, THOUGHT or WORD PROBLEMS) on the COLOR COMPUTER. It is suitable for use in either a home or school environment. It is also a tool that will allow you to create new story problems to suit your children's needs and ability levels. It has many features that make it particularly attractive: Story problems involving addition, subtraction, multiplication, division or a combination of the four are presented to the student by slowly scrolling each letter of each problem onto the screen. Up to 5 students may use the program at the same time. There are 4, user modifiabale, skill levels. 16K Ext. Basic **TAPE $19.95**

CLOCK-With the ever increasing use of digital clocks, more and more young people are unpracticed in the use of the "ANALOG" clocks. You remember those, the ones with the hands. This program will attempt to teach the relationship between the two types of clocks. **REQUIRES 16K EXT. BASIC $14.95**

SPELLING TEST is designed to give a standard oral spelling test using the audio track of the computer's tape recorder to dictate test words and sample sentences. Student responses are typed on the keyboard and checked by the computer. Results are displayed on the screen and (if connected) on a printer. **REQUIRES 16K EXT. BASIC $19.95**

MATH DRILL is a program designed to help children to practice addition, subtraction, multiplication, and division skills on the COLOR COMPUTER. It has several features that make its use particularly attractive.

- •Up to 6 students may use the program at the same time.
- •Answers for addition, subtraction and multiplication are entered from right to left, just as they are written on paper.
- •Commas may be included in the answers.
- •Partial products for the multiplication problems may be computed on the screen.
- •Division answers that have a remainder are entered as a whole number followed by the letter "R" and the remainder.
- •There are ten, user modifiable, skill levels.
- •A "SMILEY FACE" is used for motivation and reward. Its size increases relative to the skill level.
- •Skill levels automatically adjust to the student's ability.
- •A timer measures the time used to answer each problem and the total time used for a series of problems.
- •After a problem has been answered incorrectly the correct answer appears under (above in division) the incorrect answer.

REQUIRES 16K EXT BASIC $19.95

WORD DRILL is designed to give a multiple choice vocabulary quiz. Words and definitions are entered into the program from the keyboard or from a tape file. The computer displays a randomly chosen definition and eight word choices. The student must enter his response before a built in timer reaches zero.

REQUIRES 16K EXT. BASIC $19.95

SEARCH-A-WORD This Program generates a word search puzzle to your specifications. You specify the size of the puzzle and the number of words that it is to hide within the puzzle. 16K or 32K Ext. Basic. **TAPE $17.95 FLEX VERSION $27.95**

EDUCATIONAL PACKAGE — SPELLING TEST — WORD DRILL — MATH DRILL — ESTIMATE — ALL FOR — $69.95

ESTIMATE is a program designed to help children to practice estimating the answers to addition, subtraction, multiplication and division problems on the COLOR COMPUTER. It has many features that make its use particularly attractive:

- •Up to 5 students may use the program at the same time.
- •There are 5, user modifiable, skill levels.
- •The acceptable percent error may be changed as a student's skill improves.
- •A timer measures the number of seconds used to answer each problem and the total time used for a series of problems.
- •If a problem has been answered incorrectly, the student is told the percent error and asked to try again.
- •If a problem is answered incorrectly a second time, the student is told the correct answer and the range of acceptable answers is displayed.
- •A report is given at the end of each set of problems that includes the number of problems done, the number of problems answered correctly on the first try and the average percent error.
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```
1940 FOR J=0 TO 5
1950 EVNT(J,I-K)=EVNT(J,I)
1960 NEXT J
1970 IF EVNT(0,I)=0 THEN K=K+1
1980 NEXT I
1990 EC=EC-K
2000 GOTO 520
2010 'LOAD FROM DEVICE
2020 CLS1:PRINT"<LOAD SCHEDULE>"
2030 INPUT"FILE NAME";FLNM$
2040 IF FLNM$= "" THEN 530 ELSE
OPEN"I",DV,FLNM$
2050 INPUT#DV,EC,DN:' READ HDR
2060 FOR I=1 TO DN
2070 INPUT#DV,ADN(I),AD$(I)
2080 NEXT I
2090 FOR I=1 TO EC
2100 FOR J=0 TO 5
2110 INPUT#DV,EVNT(J,I)
2120 NEXT J,I
2130 CLOSE DV: PRINT FLNM$;" LOA
DED"
2140 FOR I=1TO300:NEXTI:GOTO 520
2150 'SAVE SCHEDULE TO DV
2160 CLS1:PRINT"<SAVE SCHEDULE>"
2170 INPUT"FILE NAME";FLNM$
2180 IF FLNM$="" THEN 530 ELSE O
PEN"O",DV,FLNM$
2190 PRINT#DV,EC,DN:' SAVE HDR
2200 FOR I=1 TO DN
2210 PRINT#DV,ADN(I),AD$(I)
2220 NEXT I
2230 FOR I=1 TO EC
2240 FOR J=0 TO 5
2250 PRINT#DV,EVNT(J,I)
2260 NEXT J,I
2270 CLOSE DV: PRINT FLNM$;" SAV
ED"
2280 GOTO 2140
2290 'HELP
2300 CLS 1
2310 PRINT"<COMMAND LIST>"
2320 PRINT"I    insert event comm
and"
2330 PRINT"D    detail events"
2340 PRINT"L    load new schedule
 from disk"
2350 PRINT"S    save schedule to
disk"
2360 PRINT"H    help"
2370 PRINT"C    clock:set time"
2380 PRINT"V    view next day"
2390 PRINT"@    do a direct comma
nd"
2400 PRINT"BRK exit to BASIC"
2410 SOUND 240,2:GOTO920
2420 CLS 1:END
2430 '@ DIRECT COMMAND
2440 CLS 1
2450 PRINT"<DIRECT COMMAND>"
```

```
2460 GOSUB 2780
2470 HC=BTAB(HC)*16
2480 X=USR3(768+HC+BTAB(UN))
2490 IF CB=0 THEN RP=3 ELSE RP=2
*CB+1
2500 FOR I=1 TO 100:NEXT I
2510 X=USR3(&H4000+RP*256+HC+CX)
2520 GOTO 520
2530 CLS 1: PRINT"<SET CLOCK>"
2540 GOSUB 2580
2550 X=USR0(DAY-1)
2560 X=USR1(HR*256+MIN)
2570 GOTO 920
2580 'GET DAY AND TIME
2590 INPUT"DAY OF THE WEEK";A$
2600 IF LEN(A$)<2 THEN 2620
2610 DAY=(INSTR(1,"SUMOTUWETHFRS
AAL",LEFT$(A$,2))+1)/2
2620 IF DAY<1 THEN PRINT"ENTER S
UN,MON...OR 'ALL'":GOTO 2590
2630 INPUT"24 HR TIME (HH:MM)";H
R,MIN
2640 IF HR>23 OR MIN>59 THEN2630
2650 RETURN
2660 'DRAW LINE TO RIGHT MARGIN
2690 TH=FIX(EVNT(1,I)/100)
2700 IF(EVNT(1,I)-TH*100)>30 THE
N TM=1 ELSE TM=0
2710 TA=HUE(FIX(LC/10))
2720 Y=DI*2+5
2730 IF TA=0 THEN 2760
2740 FOR X=TH*2+16+TM TO 63:SET(
X,Y,TA):NEXT X
2750 RETURN
2760 FOR X=TH*2+16+TM TO 63:RESE
T(X,Y):NEXT X
2770 RETURN
2780 'GET DATA FOR A BSR COMMAND
2790 INPUT"HOUSE & UNIT";B$
2800 IF B$="" THEN 2790
2810 HC=ASC(B$)-64
2820 UN=VAL(MID$(B$,2))
2830 IF HC>0 AND HC<17 AND UN>0
AND UN<17 THEN 2850
2840 PRINT"ENTER AS: C12 (HOUSE
C, UNIT 12)": GOTO 2790
2850 INPUT"ACTION";A$
2860 IF A$="" THEN RETURN
2870 CX=INSTR(1,"CLALONOFDIBR",L
EFT$(A$,2))
2880 IF CX=0 THEN PRINT"CLR,ALL,
ON,OFF,DIM.BR?": GOTO 2850
2890 CX=(CX-1)/2
2900 CB=0: IF CX>3 THEN CB=VAL(R
IGHT$(A$,1))
2910 RETURN
2915 PCLEAR 1: CLEAR 200,&H3D00
2920 IF PEEK(&HC000)<>68 THEN 11
0 ELSE FILES 1:GOTO 100
```

```
270.....0263
400.....0543
END...08FC
```

Listing 2:

```
10 'BSR M/L BUILDER
20 CLEAR 100,&H3D00:' FOR 16K
30 ML=PEEK(39)*256+PEEK(40)+1
40 FOR I=ML TO ML+564
50 READ A: POKE I,A: NEXT I
60 SAVEM"X10CLK",ML,ML+564,&HA02
7
70 END
200 DATA 22,0,145,22,0,159,22,1,
9,22,1,178,79,106,141
210 DATA 0,32,46,100,48,141,0,26
,134,120,167,132,166,130,45
220 DATA 88,139,1,25,167,132,161
,6,45,28,111,132,32,239,255
230 DATA 255,255,255,255,0,0,7,3
6,96,96,0,255,0,255,0
240 DATA 106,140,242,141,203,110
,156,243,230,140,230,88,88,48,14
1
250 DATA 0,43,58,198,4,206,4,20,
189,165,154,48,140,213,141
260 DATA 10,134,58,167,192,141,4
,134,58,167,192,166,132,68,68
270 DATA 68,68,138,48,167,192,16
6,128,132,15,138,48,167,192,57
280 DATA 19,21,14,32,13,15,14,32
,20,21,5,32,23,5,4
290 DATA 32,20,8,18,32,6,18,9,32
,19,1,20,32,189,179
300 DATA 237,77,45,3,231,140,144
,79,230,140,140,189,180,244,57
310 DATA 140,32,55,190,255,248,2
38,1,239,140,135,51,140,137,239
320 DATA 1,52,2,182,255,3,138,1,
183,255,3,206,1,106,166
330 DATA 196,174,65,167,141,255,
111,175,141,255,108,134,126,48,1
41
340 DATA 0,148,167,196,175,65,13
4,18,167,140,200,53,2,189,179
350 DATA 237,77,45,22,52,4,141,2
6,231,141,255,65,53,2,141
360 DATA 18,231,141,255,58,111,1
41,255,55,28,239,236,141,255,47
370 DATA 189,180,244,57,95,140,2
03,16,128,10,44,250,139,10,52
380 DATA 2,234,224,57,189,179,23
7,52,4,141,234,231,141,0,60
390 DATA 53,2,141,226,231,141,0,
53,26,16,182,255,32,133,1
400 DATA 38,249,142,7,208,48,31,
```

```
39,44,182,255,32,133,1,39
410 DATA 245,23,254,205,236,141,
254,235,16,163,141,0,17,39,17
420 DATA 173,159,160,0,39,215,31
,137,79,189,180,244,28,239,57
430 DATA 0,255,79,95,189,180,244
,57,204,255,255,189,180,244,57
440 DATA 50,98,23,254,204,15,112
,13,111,16,38,0,70,52,20
450 DATA 174,141,254,188,191,1,1
3,134,239,167,159,0,136,182,255
460 DATA 32,133,1,38,249,142,7,2
08,48,31,39,31,182,255,32
470 DATA 133,1,39,245,23,254,112
,173,159,160,0,39,226,198,96
480 DATA 231,159,0,136,48,141,25
4,144,191,1,13,53,148,48,141
490 DATA 254,135,191,1,13,126,16
1,179,126,161,127
500 DATA 189,179,237,237,141,0,1
13,132,63,167,141,0,106,141,57
510 DATA 141,55,141,53,141,46,16
6,141,0,96,142,0,8,141,19
520 DATA 166,141,0,86,73,142,0,1
,141,9,106,141,0,75,38
530 DATA 223,57,0,252,73,37,6,14
1,13,141,16,32,4,141,12
540 DATA 141,5,48,31,38,239,57,4
9,140,233,32,3,49,140,229
550 DATA 52,18,182,255,32,133,1,
39,249,134,52,74,38,253,198
560 DATA 3,166,164,183,255,32,13
4,178,74,38,253,127,255,32,28
570 DATA 0,90,39,8,134,248,18,74
,38,252,32,230,53,146
```


Kodomo-No-Go And *Tic-Tac-Toe* Two Fun Programs In A Row

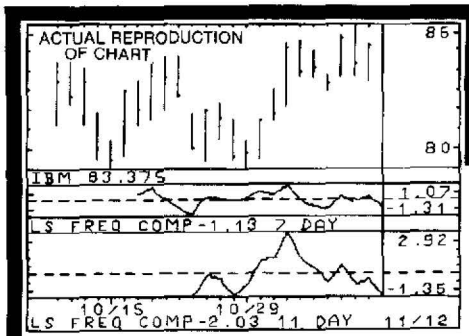
Hello all you Tic-Tac-Toe fans out there. If you love Tic-Tac-Toe, here's the ultimate program for you. Its name is *Kodomo-No-Go*, a Japanese version with a 19 x 19 grid. The object is to put five of your markers in a row vertically, horizontally or diagonally. The grid is selected by lettered rows and columns. There are two different ways to play—with a friend or against the computer. When you play with a friend, the only thing the computer does is check the moves to make sure they are on the board. Playing against the computer, you'll find there are six different skill levels. It takes the computer about one minute to make its decision where to move. So don't get restless if you have to wait a while. The instructions tell you to *POKE65495,0* to speed up the game. It was still slow even on Level 1.

If you don't want to get too complicated with *Kodomo-No-Go*, there's still good old *Tic-Tac-Toe*. You get the usual 3 x 3 playing grid and two skill levels. This program also uses letters to show the location of the move. It doesn't take as long to move in *Tic-Tac-Toe*. You can't beat the computer in the expert level. There is also a two player version where the computer just checks moves.

The only thing I can say is have fun and don't get discouraged. The one problem I had with the game is the length of time it took the computer to move. The graphics use only three colors. I would recommend these games to anyone who enjoys playing Tic-Tac-Toe.

(Intercept Enterprises, P.O. Box 4016, Cherry Hill, NJ 08034, 16K tape, $14.95, 32K tape, $19.95)

—Pat Downard



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No, I'm not kidding. *El Cheapo A/D Converter* really is the name of the software. Most of you know what "El Cheapo" means. "El Cheapo" is pseudo Spanish for "inexpensive." My wife says that she understands pseudo Spanish just fine but that "A/D Converter" is Greek to her.

Translation: A/D Converter is short for Analog to Digital Converter. An Analog to Digital converter is something that takes continuously variable signals and converts the signals into a stream of binary numbers. Ouch! I just got "elbowed" in the side. She says that my "translation" has not lifted any lingual barriers. Okay. Put simply, an A/D converter gives your computer a set of ears so that it can listen to the real world outside. An A/D converter can take your voice through a microphone and deliver it to your computer in a form that the computer will accept. An A/D converter can also be used to sense the position of a joystick and translate that sense of position into the numerical terms that your computer requires. It is for this purpose that the Color Computer has an A/D converter built in.

El Cheapo is a machine language program which allows the CoCo's built in A/D converters to run at high speed. High speed is necessary to record fast moving wave forms like your voice. Instructions are given on modifying one of your joysticks to accept voice input from your tape recorder. Once the computer has received the voice (digitized the voice), it is possible for you to rearrange or alter the patterns. You can save the patterns as complete words or cut them up into individual phonemes. The computer could then reconnect the saved words or phonemes to produce artificial speech.

The instructions for *El Cheapo* are complete; however, I recommend that you have some experience with soldering before you attempt to modify your joystick. If everything is done right, the performance of your joystick will not be adversely affected.

It's available for 16 or 32K.

(Zeta Software, P.O. Box 3522, Greenville, SC 29608-3522, $14.95)

—Dr. Laurence D. Preble

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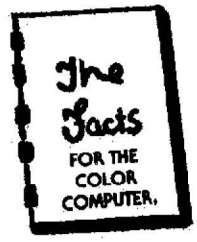
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This grown-up version of Battleship is the toughest thinking game available. There is no luck involved as you seek out the computers hidden fleet.
Cassette only **$14.95**

CAVE HUNTER by Mark Data Products
Fast-paced action for the Color Computer. Super Hi-Res graphics, dynamite sound effects. This game will astonish you with its detail and quality.
Cassette only **$24.95**

SPACE TRADERS by Spectral Associates
Space Traders is a fast moving galactic trading game for the Color Computer. Requires Ext. BASIC.
Cassette only **$14.95**

TYPING TUTOR

This personal typing teacher allows you to learn at your own pace whether a beginner or just a little rusty. 16K

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RAINBOW SCOREBOARD

Give us your best: Join the ranks of these courageous CoCoists in showing the Color Computer world your high score at your favorite micro-diversion. We want to put your best effort on record in *the Rainbow's* Scoreboard column. All entries must be received by the first of the month to be eligible for the following month's Scoreboard.

★ **New Number One** ☆ **Last Month's Number One**

SCORE		PLAYER
ALCATRAZ II		
8,710	★	Kanti Dinda, Kingston, Ontario
ASTRO BLAST		
158,000	☆	Larry Plaxton, Medley, Alberta
98,000		Tim Warr, Bellingham, WA
92,000		Harry Sawyer, Watchung, NJ
92,000		Roland Hendel, Mississauga, Ontario
82,925		Greg Lesher, North Chili, NY
61,050		John Osborne, Kincardine, Ontario
48,550		Jimmy McDonald, Summerville, SC
ASTEROID		
2,322	★	Matt McMann, New Boston, MI
AVENGER		
19,220	★	Vince Lok, Mississauga, Ontario
14,075	☆	Stephen Lai, Palatine, IL
11,560		Peter Niessen, Carlisle, MA
8,305		Jimmy McDonald, Summerville, SC
5,345		Craig Schubert, Newfoundland, NJ
BLEEP		
105	★	Matt McMann, New Boston, MI
BLOC HEAD		
40,250	★	Ed Bottini, St. Louis, MO
19,300		Jim Ganninger, Des Peres, MO
17,400		Brad Ilowit, Orlando, FL
BUSTOUT		
42,100	★	Derrick Kardos, Colonia, NJ
34,700	☆	Sara Hennessey, Golden Valley, MN
28,720		Perry Denton, New Baden, IL
25,510		Andy Klingler, San Diego, CA
17,170		Neil Berkman, DeWitt, NY
9,010		Tim Warr, Bellingham, WA
6,560		Rich VanManen, Grand Rapids, MI
CANYON CLIMBER		
95,600	★	Kyle Keller, Overland Park, KS
84,500		J.C. MacDonald, Charlottetown, P.E.I., Canada
69,900		Todd Byington, N. Salt Lake, UT
50,800		Marc Hassler
40,500		Danny R. Woodfin, Williamstown, WV
CATCH 'EM		
237,000	★	Craig Edelheit, W. Bloomfield, MI
91,000	☆	Dean Bouchard, Kingston, Nova Scotia
65,768		Laura Sandman, Louisville, KY
CATERPILLAR		
63,100	★	Todd Byington, N. Salt Lake, UT
30,029	☆	Ron Rhead, Willowdale, Ontario
CAVE HUNTER		
42,600	★	Gary Ritchie, Bellevue, Alberta
26,300		Mike Hughey, King George, VA
21,150		Jim Baker, Florissant, MO
21,050		Brian Wallingford, Fall River, MA
CLOWNS & BALLOONS		
65,050	☆	Brian Gould, Basking Ridge, NJ
64,130		Doug Schofield, Plainfield, IL
62,100		Greg Lesher, North Chili, NY
61,700		Dan Dowling, San Bruno, CA
46,930		Stephen Shotts, Blacksburg, VA
42,080		Kyle Keller, Overland Park, KS
28,200		Neil Berkman, DeWitt, NY
COLOR HAYWIRE		
22,050	★	Jim Baker, Florissant, MO
17,850		Brian Wallingford, Fall River, MA
14,650	☆	Todd C. Hauschildt, Red Wing, MN
14,350		Mike Hughey, King George, VA
12,600		Tim Warr, Bellingham, WA
11,050		Roland Hendel, Mississauga, Ontario
8,410		Justin Marcus
8,100		Neil Berkman, DeWitt, NY
7,650		Scott Snyder, Allentown, PA
7,000		Ron Rhead, Willowdale, Ontario
6,800		Jason Margolis, Flushing, NY
COLOR INVADERS		
240,700	★	Roland Hendel, Mississauga, Ontario
227,050		John Osborne, Kincardine, Ontario
166,425	☆	Jim Baker, Florissant, MO
126,350		Perry Denton, New Baden, IL
101,240		Larry Plaxton, Medley, Alberta

SCORE		PLAYER
COLOR METEROIDS		
1,496,000	★	Craig Edelheit, W. Bloomfield, MI
1,253,200		Jeff White, Prairie du Chien, WI
292,000		Roland Hendel, Mississauga, Ontario
292,000		Vince Lok, Mississauga, Ontario
252,050	☆	Larry Plaxton, Medley, Ontario
68,600		Kyle Keller, Overland Park, KS
COLORPEDE		
2,745,982	★	Roland Hendel, Mississauga, Ontario
2,139,248	☆	Mike Hall, Hartland, WI
2,005,227		Jennifer Maxey, Kalamazoo, MI
1,723,937		Roger Lamb, St. Petersburg, FL
1,424,653		John Osborne, Kincardine, Ontario
1,056,581		Keith Seifried, Greenville, OH
1,027,190		Robert Denton, New Baden, IL
434,201		Pat Petkash, Warren, MI
114,999		Ron Rhead, Willowdale, Ontario
COLOR SCARFMAN		
976,520	☆	Bruce Thornhill, Barrhead, Alberta
772,000		Keith Seifried, Greenville, OH
600,410		Roland Hendel, Mississauga, Ontario
539,100		Larry Plaxton, Medley, Alberta
523,340		Fred K. Herrman, Flemington, NJ
COLOR ZAP		
227,330	☆	Ron Rhead, Willowdale, Ontario
50,800		Scott Sehlhorst, Columbia, SC
COLOUR PAC ATTACK		
472,465	☆	Jim Baker, Florissant, MO
211,000		Roland Hendel, Mississauga, Ontario
193,000		Cameron Amick, Reisterstown, MD
154,600		Greg Lesher, North Chili, NY
88,450		Matthew Brenengen, Lake Elmo, MN
67,890		Neil Berkman, DeWitt, NY
67,435		Brian Wallingford, Fall River, MA
59,600		Ed Bottini, St. Louis, MO
48,505		Tim Warr, Bellingham, WA
46,890		Judy Boyer, Plymouth, IN
36,420		Jim Ganninger, Des Peres, MO
29,820		Elena Berkman, DeWitt, NY
28,895		Richard Vehlow, Bayside, NY
9,250		Linda Berkman, New York, NY
CONQUEST OF KZIRGLA		
50,199	★	Bruce Uher, Coshocton, OH
10,399	☆	Scott Sehlhorst, Columbia, SC
COSMIC CLONES		
30,700	★	John Osborne, Kincardine, Ontario
CROSSWORDS		
322	★	Bob Strong, Chicago, IL
DEATH TRAP		
75,431	★	Jeff Willard, Chireno, TX
41,272		Perry Willard, Chireno, TX
33,777		Dawayne McKinney, Chireno, TX
30,119		Trey Lowery, Chireno, TX
DEFENSE		
58,900	☆	Greg Scott, Orlando, FL
DEMON ASSAULT		
49,000	★	Steve Mooney, W. Bloomfield, MI
DOODLE BUG		
1,152,360	★	Marc Hassler
825,000	☆	John Cole, King City, Ontario
491,380		James Stewart, Delhi, NY
456,000		Peter Stumpf, McHenry, IL
355,440		Bette Munitz, Bellerose, NY
340,740		Bill Tyler, St. Paul, MN
200,120		Roland Hendel, Mississauga, Ontario
154,650		Theodore Mayor, East Greenbush, NY
106,280		Scott Snyder, Allentown, PA
77,310		Sandy Nierste, Clio, MI
DOUBLEBACK		
435,570	★	Phillippe Morsan, St. Jerome, Quebec
429,000		Steve Damm, Phoenix, AZ
195,640		Terry Steen, San Bernardino, CA
191,830		Chris Kulawy, St. Johnsville, NY
127,460		Kyle Keller, Overland Park, KS
126,210	☆	Craig M. Arnold, Dallas, TX
110,970		Nancy Magee, Collins, MS
108,410		Bill Tyler, St. Paul, MN
81,090		Mary M.V. Wahl, Minneapolis, MN
76,590		John Wahl, Minneapolis, MN
66,250		J.C. MacDonald, Charlottetown, P.E.I. Canada
57,800		Justin Paola, Berkeley, CA

SCORE		PLAYER
DUNKEY MUNKEY		
1,618,800	☆	Bryan Bloodworth, Federal Way, WA
1,099,400		Andrew Herron, High Point, NC
1,000,500		Wendy Johnson, San Jose, CA
1,000,001		Grant Gillott, Calgary, Alberta
626,400		Peter Niessen, Carlisle, MA
444,300		Roland Hendel, Mississauga, Ontario
320,200		Vince Lok, Mississauga, Ontario
THE FROG		
30,500	★	Frank Bottini, St. Louis, MO
15,400	☆	Debbie Purdy, Dearborn, MI
9,460		Marc Hassler
FROGGER		
8,600	★	Tim Warr, Bellingham, WA
FROG-MAN		
3,735	★	Aaron T. Cincotta, Peru, IN
FROG TREK		
12,250	★	Alan Weiss, Summit, NJ
10,370	☆	Jim Baker, Florissant, MO
8,550		Tom Eberhardt, Fairview Park, OH
7,160		Mike Anheluk, Fall Creek, OR
GALACTIC ATTACK		
58,000	★	Terry Steen, San Bernadino, CA
54,200	☆	Mike Hughey, King George, VA
54,000		Craig Edelheit, W. Bloomfield, MI
48,320		John Cole, King City, Ontario
45,900		Rick Williams, Kokomo, IN
41,390		Steve Johnson, Santa Ana, CA
40,970		Rich VanManen, Grand Rapids, MI
26,970		Jeff Willard, Chireno, TX
23,860		Derek Fosbury, Caledonia, Ontario
19,760		Linda Herbers, Placentia, CA
GALAX ATTAX		
46,450	☆	Robert Rahmes, Silver Spring, MD
33,350		Aaron Cundiff, Livermore, KY
33,000		Todd Zuehl, Livermore, KY
30,350		Mark Raphael, Englishtown, NJ
27,600		Miles C. Langmacher, Minco, OK
GHOST GOBBLER		
825,250	☆	Randy Gerber, Wilmette, IL
255,000		John Osborne, Kincardine, Ontario
142,070		Chris Kulawy, St. Johnsville, NY
110,190		Jeff Morris, Seattle, WA
103,590		Harry Sawyer, Watchung, NJ
59,830		Rubén Lipszyc, Sarnia, Ontario
56,200		Jim Ganninger, Des Peres, MO
55,390		Ron Rhead, Willowdale, Ontario
55,340		Phillippe Morsan, St. Jerome, Quebec
53,250		Terry Steen, San Bernardino, CA
INVADERS REVENGE		
451,060	★	John Osborne, Kincardine, Ontario
32,600	☆	Harry Sawyer, Watchung, NJ
KATERPILLAR ATTACK		
14,375	☆	Norbert Berenyi, Northvale, NJ
14,211		Roland Hendel, Mississauga, Ontario
12,703		Warren Schubert, Newfoundland, NJ
12,544		Todd C. Hauschildt, Red Wing, MN
12,100		Peter Stumpf, McHenry, IL
9,164		John Osborne, Kincardine, Ontario
8,415		Scott Snyder, Allentown, PA
8,010		Jimmy McDonald, Summerville, SC
KEYS OF THE WIZARD		
640	★	Steve Skrzyniarz, Tacoma, WA
THE KING		
1,858,000	☆	Mike Hughey, King George, VA
1,670,200		Joel Doucet, Yarmouth, Nova Scotia
1,549,200		Frank Bottini, St. Louis, MO
1,000,000		Debbie Purdy, Dearborn, MI
950,600		Tim Warr, Bellingham, WA
842,900		Roland Hendel, Mississauga, Ontario
805,700		Dave Mercer, Marissa, IL
592,400		Hwan Joo, Weston, Ontario
577,000		Mike Rausch, Denver, CO
494,900		Perry Denton, New Baden, IL
469,600		Kyle Keller, Overland Park, KS
332,100		Candy Harden, Birmingham, AL
312,000		Matt McMann, New Boston, MI
252,000		Todd Byington, N. Salt Lake, UT
228,300		Roger Buzard, Lima, OH
188,000		Peter Stumpf, McHenry, IL
160,000		Scott Wedlake, Hudson, FL

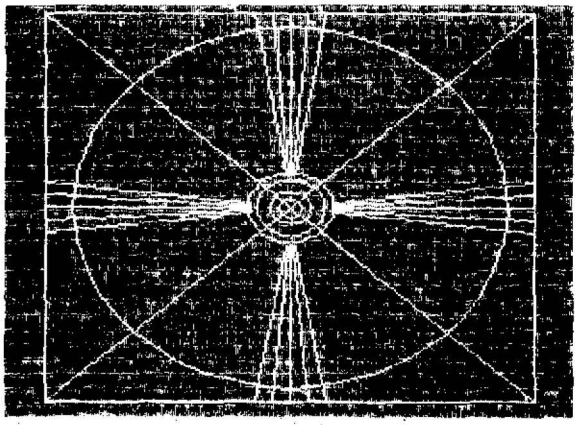
SCORE		PLAYER
KOSMIC KAMIKAZE		
49,900	☆	Mark Raphael, Englishtown, NJ
MEGA-BUG		
60,000	★	Robin Worthem, Milwaukee, WI
16,598		John Tiffany, Washington, D.C.
15,999		Ed Mitchell, Ragged Mountain, CO
13,850		Jim Martin, Uniontown, OH
13,783	☆	Donald Habben, Morrison, IL
13,481		Rich VanManen, Grand Rapids, MI
13,388		Dixie Mitchell, Ragged Mountain, CO
9,650		Derek Fosbury, Caledonia, Ontario
9,065		Al Byington, N. Salt Lake City, UT
9,049		Sheri Louis, Streator, IL
8,768		Robert L. Bull, Trenton, Ontario
8,481		Valerie Hassler
8,333		Debra Burkett, Morgan City, LA
8,237		Kyle Keller, Overland Park, KS
7,966		Jim Brinkman, Plymouth, IN
7,596		Judy Boyer, Plymouth, IN
4,437		Marcus Muller, Farmington, ME
MEGAPEDE		
67,605	★	Ed Bottini, St. Louis, MO
53,019		Jim Ganninger, Des Peres, MO
METEORS		
17,810	☆	Lenny Munitz, Bellerose, NY
MICROBES		
318,830	★	Hwan Joo, Weston, Ontario
316,200		Steve Mayer & Keith Seifried, Greenville, OH
259,700	☆	Sheila Coleman, Griffin, GA
88,120		Kevin Little, Somers, IA
80,400		Ken Miller, Yardley, PA
30,070		Bob Hosken, Mentor, OH
16,990		Richard Vehlow, Bayside, NY
14,250		Steven H. Ng, Scarborough, Ontario
MOON HOPPER		
809,750	★	Ed Bottini, St. Louis, MO
142,800		Ron Rhead, Willowdale, Ontario
MORROCO GRAN PRIX		
4,153	★	Frank Bottini, St. Louis, MO
MR. MUNCH		
35,780	★	Jeff Morris, Seattle, WA
24,680	☆	Alan Mak, Penn Yan, NY
MONKEY KONG		
1,182	★	Rich VanManen, Grand Rapids, MI
1,072		Justin Marcus
1,052		Ryan VanManen, Grand Rapids, MI
1,028	☆	Larry Plaxton, Medley, Alberta
963		Mark Dowling, San Bruno, CA
MONSTER MAZE		
520,470	★	Robert L. Bull, Trenton, Ontario
323,490		Philip Morrissey, Gilboa, NY
62,400		Ruben Lipszyc, Sarnia, Ontario
60,000	☆	Brian Austin, Rotterdam, NY
56,030		Keith Seifried, Greenville, OH
5,090		Steven H. Ng, Scarborough, Ontario
NERBLE FORCE		
315,150	★	Frank Bottini, St. Louis, MO
49,200		Jim Ganninger, Des Peres, MO
NIBBLER		
14,910	☆	Christal Glovinsky, Staten Island, NY
OFFENDER		
965,400	☆	Jim Baker, Florissant, MO
113,200		Justin Marcus
76,350		Johnna Miller, Plymouth, MN
PAC-DROIDS		
577,140	☆	Richard Cochrane, Wayne, NJ
151,590		Annita Powell, Huber Heights, OH
140,300		John Yapp, Park Forest, IL
94,140		Lee Powell, Huber Heights, OH
49,180		Jimmy McDonald, Summerville, SC
42,600		Justin Marcus
40,960		Stephen Shotts, Blacksburg, VA
27,230		Jerry Hoogwerff Kroon, Rozenburg, Holland
PACET-MAN		
26,800	★	Vince Lok, Mississauga, Ontario
5,000	☆	Cameron Amick, Reisterstown, MD
3,392		Norbert Berenyi, Northvale, NJ
PARACHUTE JUMP		
451,000		John Osborne, Kincardine,Ontario
PHANTOM SLAYER		
1,306	★	Marc Hassler
406		Imre Kertesz, Chandler, AZ
197		Mark Heizler, Ridgefield, CT
180	☆	Mike Hall, Hartland, WI
PINBALL		
4,000,000	★	Keith Seifried, Greenville, OH
66,650	☆	Ken Miller, Yardley, PA

SCORE		PLAYER
PLANET INVASION		
286,075	☆	Larry Plaxton, Medley, Alberta
257,900		Ron Rhead, Willowdale, Ontario
221,350		John Cole, King City, Ontario
207,150		Mike Hughey, King George, VA
84,300		Matt McMann, New Boston, MI
82,000		Harry Sawyer, Watchung, NJ
79,650		Justin Marcus
POLARIS		
256,018	★	Michael Popovich, Sr., Nashua, NH
212,746		Hwan Joo, Weston, Ontario
170,100		Steve Johnson, Santa Ana, CA
151,154	☆	Brian Austin, Rotterdam, NY
120,824		Rich VanManen, Grand Rapids, MI
113,773		Linda Herbers, Placentia, CA
101,000		Michael Popovich, Nashua, NH
POLTERGEIST		
4,978	★	Tim Warr, Bellingham, WA
4,956	☆	Mark Dowling, San Bruno, CA
4,835		Scott Butler, Springfield, IL
4,745		Bette Munitz, Bellerose, NY
4,630		Jim Ganninger, Des Peres, MO
4,455		Ken Miller, Yardley, PA
4,395		Scott Snyder, Allentown, PA
POPCORN		
560,900	★	Vince Lok, Mississauga, Ontario
168,680		Steve Johnson, Santa Ana, CA
110,570	☆	Cameron Amick, Reisterstown, MD
77,970		Raymond G. Myers, Bloomington, IL
56,000		James Quadarella, Brooklyn, NY
38,500		Terry Steen, San Bernadino, CA
PROTECTORS		
594,610	★	Roland Hendel, Mississauga, Ontario
358,514	☆	Cameron Amick, Reisterstown, MD
272,000		Douglas Hug, Roseville, CA
154,967		Frankie Jimenez, Mesa, AZ
94,000		Gerry Schechter, Yonkers, NY
RAIL RUNNER		
53,400	★	Ed Bottini, St. Louis, MO
38,360		Jim Baker, Florissant, MO
13,195		Lenny Munitz, Bellerose, NY
ROBOTTACK		
1,197,800	☆	Brian Austin, Rotterdam, NY
1,146,750		Justin Marcus
939,300		Robert Kiser, Monticello, MS
773,250		Matt Brenengen, Lake Elmo, MN
708,650		Tony Cappellini & Randy Clemmery, Lemoore, CA
675,600		Tony Cappellini, Lemoore, CA
649,500		Joseph Prisco, Oswego, NY
600,700		Bill Tyler, St. Paul, MN
574,000		Ron Rhead, Willowdale, Ontario
545,850		Jay Stewart, Delhi, NY
507,000		Craig Edelheit, W. Bloomfield, MI
492,650		Alan Burkett, Seneca, SC
406,650		David Lack, Glendale, CA
SEA DRAGON		
36,540	★	Steve Schweitzer, Sewell, NJ
14,970		Ron Rhead, Willowdale, Ontario
SHAFT		
18,150	★	Loren Seng, Tuscon, AZ
SHARK TREASURE		
72,000	★	Marc Hassler
48,000		Ed Bottini, St. Louis, MO
SHOOTING GALLERY		
37,200	★	Chris Kulawy, St. Johnsville, NY
28,500	☆	Kenneth Partridge, Warkworth, Ontario
26,000		J.C. MacDonald, Charlottetown, P.E.I., Canada
23,490		David Lender, Brooklyn, NY
16,370		Saul Munitz, Bellerose, NY
16,310		Ron Rhead, Willowdale, Ontario
SKIING		
40.10	☆	Fred K. Herrmann, Flemington, NJ
49.43		John Scanlan, Prairie Village, KS
52.22		Peter Johnson, Chino, CA
53.57		Jay Stewart, Delhi, NY
57.07		John Osborne, Kincardine, Ontario
SKY DEFENSE		
9,700	★	Vince Lok, Mississauga, Ontario
6,700	☆	Mike Anheluk, Fall Creek, OR
6,120		Steve Skrzyniarz, Tacoma, WA
5,200		Cameron Amick, Reisterstown, MD
SOLO POKER		
640	★	Mary J. Herring, Bloomington, IL
SOLO POOL		
103	☆	John W. Fraysse, Dahlgren, VA
SPACE ACE		
983	★	Matt McMann, New Boston, MI
SPACE AMBUSH		
124,460	★	John Osborne, Kincardine, Ontario

SCORE		PLAYER
SPACE ASSAULT		
238,580	☆	John Cole, King City, Ontario
221,130		Steve Johnson, Santa Ana, CA
216,680		Chris Kulawy, St. Johnsville, NY
160,832		Rich VanManen, Grand Rapids, MI
157,140		David Milbrath, Ann Arbor, MI
112,250		Tim Warr, Bellingham, WA
102,650		Ruben Lipszyc, Sarnia, Ontario
102,410		Keith Siefried, Greenville, OH
97,300		Terry Steen, San Bernardino, CA
55,000		Fred Boyer, Plymouth, IN
41,060		Kanti Dinda, Kingston, Ontario
38,120		Debra Burkett, Morgan City, LA
SPACE INVADERS		
62,300	☆	Peter Niessen, Carlisle, MA
10,570		Neil Berkman, DeWitt, NY
SPACE RACE		
77,075	★	John Osborne, Kincardine, Ontario
59,825	☆	Jim Baker, Florissant, MO
58,100		John Cole, King City, Ontario
31,525		Gregg Scott, Orlando, FL
4,000		Danielle Gardner, Louisville, KY
SPACE SENTRY		
41,129	★	Steve Skrzyniarz, Tacoma, WA
SPACE SHUTTLE		
595	☆	Steve Schweitzer, Sewell, NJ
575		Fred Weissman, Brookline, MA
571		Ted McDonald, Summerville, SC
565		John W. Fraysse, Dahlgren, VA
511		Larry Reitz, Toledo, OH
SPACE WAR		
400,190	☆	Mark Felps, Bedford, TX
116,000		Peter Niessen, Carlisle, MA
52,380		Jim Baker, Florissant, MO
STARBASE ATTACK		
21,628	☆	Mark Raphael, Englishtown, NJ
STARBLASTER		
408,245	☆	Mark Dowling, San Bruno, CA
325,790		Mike Anheluk, Fall Creek, OR
126,135		Mike Hall, Hartland, WI
80,001		Alan Lewis, Ridgefield, CT
52,050		Greg Lesher, North Chili, NY
STARFIRE		
3,444,500	★	John DeMuth, Prairie du Chien, WI
2,102,450	☆	Dean Bouchard, Kingston, Nova Scotia
1,320,150		Joy Bailey, Lexington, NC
1,120,000		Emil Hayek, State College, PA
688,400		Roland Hendel, Mississauga, Ontario
100,000		Tim Warr, Bellingham, WA
STARSHIP CHAMELEON		
861,200	★	Greg Lesher, North Chili, NY
79,250		Vince Lok, Mississauga, Ontario
72,600	☆	Jim Baker, Florissant, MO
68,500		Cameron Amick, Reisterstown, MD
64,800		David Rosicky, Pittsburgh, PA
62,100		John Osborne, Kincardine, Ontario
STORM		
840,010	★	Roland Hendel, Mississauga, Ontario
723,335	☆	Chris Sweet, Harvard, MA
472,320		John Jaworski, Nashua, NY
380,000		Cameron Amick, Reisterstown, MD
240,745		Todd C. Hauschildt, Red Wing, MN
207,840		Greg Lesher, North Chili, NY
55,275		John Osborne, Kincardine, Ontario
STORM ARROWS		
94,000	★	Steven Ohsie, Houston, TX
TRAPFALL		
84,542	★	Keith Seifried, Greenville, OH
77,490		Peter Stumpf, McHenry, IL
59,163		Frank Bottini, St. Louis, MO
VENTURER		
2,152,150	☆	Greg Scott, Orlando, FL
1,769,400		Todd C. Hauschildt, Red Wing, MN
1,526,200		Peter Niessen, Carlisle, MA
1,126,550		Hwan Joo, Weston, Ontario
919,650		Richard Vehlow, Bayside, NY
WILDCATTING		
23,571	★	Jenny Petkash, Warren, MI
ZAKSUND		
950,500	★	Michael Rothman, Solon, OH
617,500		Ed Bottini, St. Louis, MO
119,650		Jeff Fisher, West Branch, MI
74,550		Derrick Kardos, Colonia, NJ
70,300		Steve Schweitzer, Sewell, NJ
62,500		Derrick Kardos, Colonia, NJ
2,600		Robert Frowenfeld, Louisville, KY
ZAXXON		
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ROY G. BIV AWARD WINNER

TRY THESE TEST PATTERNS ON YOUR COLOR MONITOR



By Mike Dubuc

Color televisions are comprised of a complexity of complicated systems and circuits which have to work in harmony to produce an intelligible image. Of all the systems that exist within the television, the one that is most susceptible to change as well as being the most neglected is the cathode ray tube (picture tube) and beam scanning system.

Simply put, this system is trying to aim and land three separate electron beams simultaneously in a precise location on the center of the CRT while being pulled around the entire face of the CRT by a magnetic force created by the "deflection yoke" (the large coil of wire that encircles the neck of the picture tube). These beams have to maintain the same shape and precision everywhere they land even though the front surface of the CRT changes shape, from being nearly flat in the center to being significantly curved at the edges.

What does all this mean? Well, the concept that I am trying to convey is that to successfully reproduce an image on the CRT, those electron beams must be corrected to overcome and withstand contortion by magnetic fields, errors of physical mislocation and registration, and mechanical shift, as well as component aging and other considerations. Through all this, we expect the beams to stay nearly perfect as they land at the various locations on the phosphor screen, the result being a properly focused picture that is aligned and conforms to the shape of the facepanel of our picture tube.

Physical adjustments and circuitry exist on color televisions that compensate for these imperfections; however, in order to take advantage of these built-in correction features it requires the generation of particular stationary test patterns not normally available to the television viewer. It occurred to me that the CoCo would make a perfect test pattern generator as its graphic and resolution capabilities are somewhat better than those most color televisions can handle.

Drawing on my past 10 years' experience as a cathode ray tube test engineer, I have put together a selection of test patterns in a program called *Congen*. This program, when run properly, allows the user to make all the adjustments necessary to properly align, converge and set up the CRT and beam scanning system on a color television.

The program is a menu driven, self prompting collection of nine modules which are totally user friendly. Some of the patterns may seem to be redundant functions, but I have found more often than not that the alignments are somewhat easier to achieve using a combination of all the available patterns. All the geometric patterns have been corrected for the standard 4 x 3 aspect ratio.

There are nine basic functions, and the following list will explain some of the details.

1) DOTS Used for dynamic convergence (edge). Lower numbers give most usable patterns.

2) CROSSHATCH Also used for dynamic convergence.

3) COLOR BAR Used for checking hue—TINT control should be adjustable to obtain noted colors.

4) GRAY SCALE Sets up pseudo levels from black to white. Although not a true gray scale, this function should be adequate in showing a television's ability to display seven distinct steps between black and white by varying CONTRAST and BRIGHTNESS.

5) CORNER MARKS Allows an evaluation of focus.

6) CENTER PATTERN Used for adjusting static convergence (center) and centering the display.

7) HORZ/VERT BARS General function useful in aligning, converging, adjusting linearity, etc.

8) PURITY/GUN C/O The purity function is used for selecting a particular color screen for adjusting the PURITY MAGNET for best field color saturation, while the GUN C/O provides a stable horizontal line for setting gun cutoff levels on those televisions without set up switches.

9) PICTURE SYMMETRY This function sets up patterns for adjusting vertical and horizontal, linearity, height and width (HEIGHT/WIDTH, RS-170 option). It also provides a rectangle for pincushion and barrel distortion and adjustment (to eliminate sides that tend to bow in or out).

Although the intended use of this program assumes that the user is somewhat versed in television alignment and repair, I believe that it is so self explanatory and easy enough to use that anyone could check the performance of their television.

Editor's Note:
Although ***Congen*** *is one of the programs in this issue available on* ***Rainbow On Tape****, you may order it directly from the author by sending a self-addressed, stamped envelope and $5 to:*

Mike Dubuc
4 Fieldstone Lane
Attleboro, MA 02703

(Mike Dubuc is a Quality Assurance Test Engineer with the Display Devices group of the Raytheon ICO Operation. He is involved in state-of-the-art cathode ray tube displays for high performance airborn applications.)

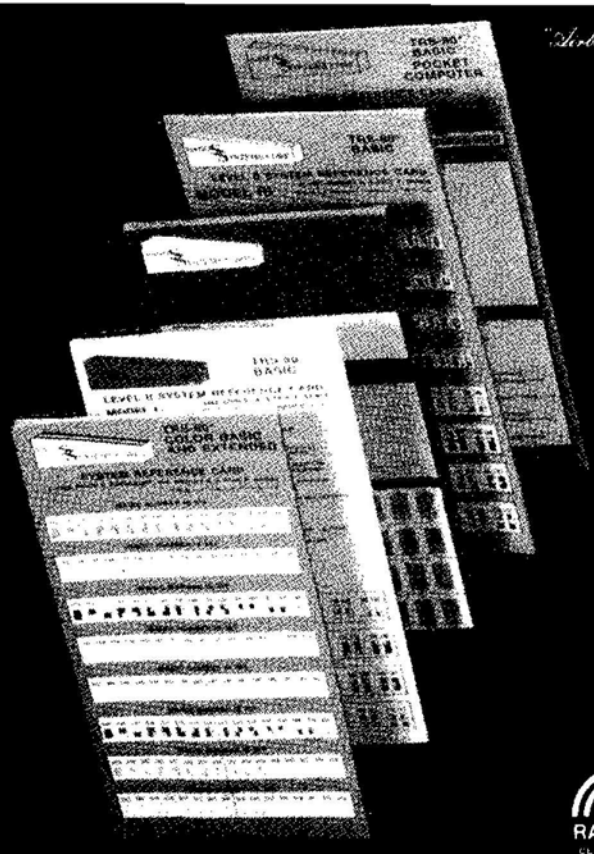
The listing:

```
53.....0284
155.....0531
380.... 07FC
691.... 0A59
900.... 0D3F
1070... 0FA0
1200....1233
1420... 14CA
END... 16BB
```

```
10 PCLS:CLEAR:CLS(4)
20 PRINT@132,"          TELEVISION
```

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```
      ";:PRINT@164,"TEST PATTERN
\CONVERGENCE";:PRINT@196,"
 GENERATOR          ";:PRINT@335,"
 MIKE DUBUC     ";:PRINT@367,"4 F
IELDSTONE LN";:PRINT@399,"ATTLEB
ORO,MA    ";:PRINT@431,"    Ø27Ø3
      ";
3Ø FOR DL=1TO2ØØØ:NEXT:CLS(3):GO
SUB2Ø6Ø
4Ø LN=Ø:PCLS:CLS(3):PRINT@74,"SE
LECT MODE";
5Ø PRINT@134,"***(1)DOTS***";:PR
INT@166,"***(2)CROSSHATCH***";:P
RINT@198,"***(3)COLOR*BAR***";:P
RINT@23Ø,"***(4)GREY*SCALE***";:
PRINT@262,"***(5)CORNER*MARKS***
";:PRINT@294,"***(6)CENTER*PATTE
RN***";:PRINT@326,"***(7)HORZ\VE
RT*BARS***";
53 PRINT@358,"***(8)PURITY*GUN C
/O***";:PRINT@39Ø,"***(9)PICTURE
*SYMMETRY***";:PRINT@45Ø,"*PRESS
 [M] FOR MENU AND ANY";:PRINT@48
2,"KEY TO RESTART CURRENT MODE*"
;
55 A$=INKEY$:IFA$=""THENGOTO55EL
SEIFA$="1"THENN=1ELSE IF A$="2"
THEN N=2 ELSE IF A$="3" THEN N=3
 ELSE IF A$="4" THEN N=4 ELSE IF
 A$="5" THEN N=5 ELSE IF A$="6"
THEN N=6 ELSE IF A$="7" THEN N=7
 ELSE IF A$="8" THEN N=8 ELSE IF
 A$="9" THEN N=9 ELSE GOT
6Ø ON N GOSUB 7Ø,16Ø,28Ø,599,69Ø
,8ØØ,9ØØ,1Ø8Ø,12ØØ
7Ø GOSUB 2Ø6Ø:CLS:PRINT@163,"SEL
ECT SPACES BETWEEN DOTS";:PRINT@
294,"ENTER A NUMBER";:PRINT@326,
"BETWEEN 3 AND 1ØØ";
8Ø INPUT Z
85 PRINT@355,"COARSE(1) OR FINE(
2) DOTS";:GOSUB2Ø5Ø
86 A$=INKEY$:IF A$="" THEN86ELSE
 IFA$="M" THEN 4Ø ELSEIFA$="1"TH
EN5ØØELSEIFA$="2"THEN9ØELSE85
9Ø PRINT@384,"INVERSE(1) OR REGU
LAR VIDEO(2)";
91 A$=INKEY$:IFA$=""THEN91ELSE I
FA$="M" THEN 4Ø ELSEIFA$="1"THEN
R=4ELSEIFA$="2"THENR=3ELSE91
1ØØ CLS:PMODE R,1
11Ø SCREEN1,1:PCLS
12Ø FOR Y=4TO184STEP Z
13Ø FORX=4TO256STEPZ
14Ø PSET(X,Y):PSET(X+1,Y):PSET(X
+1,Y+1):PSET(X,Y+1)
15Ø NEXTX:NEXTY
155 LN=1:GOTO2ØØØ
16Ø PCLS:CLS:GOSUB2Ø6Ø:PRINT@162
,"SELECT INTERSECTION INTERVAL";
:PRINT@294,"ENTER A NUMBER";:PRI
NT@326,"BETWEEN 3 AND 255";
17Ø INPUT Z
18Ø PRINT@384,"REGULAR(1) OR INV
ERSE VIDEO(2)";
181 A$=INKEY$:IFA$=""THEN181ELSE
 IF A$="M" THEN 4ØELSEIFA$="1"TH
ENR=3ELSEIFA$="2"THENR=4ELSE181
19Ø CLS:PMODE R,1
2ØØ SCREEN1,1
21Ø FORY=4TO184STEPZ
22Ø LINE(Ø,Y)-(255,Y),PSET
23Ø NEXTY
24Ø FORX=4TO256STEPZ
25Ø LINE(X,Ø)-(X,191),PSET
26Ø NEXTX
27Ø LN=2:GOTO 2ØØØ
28Ø GOSUB2Ø6Ø:L=Ø:CLS(Ø):PRINT@9
8,"THE PROPER COLOR BAR PATTERN"
;
29Ø PRINT@13Ø,"FROM LEFT TO RIGH
T IS:";
3ØØ FOR W=143 TO 255 STEP 16
31Ø PRINT@199+L,CHR$(W);:L=L+1:P
RINT@199+L,CHR$(W);:L=L+1:NEXT W
315 PRINT@324,"PRESS ANY KEY TO
CONTINUE";
32Ø A$=INKEY$:IF A$="" THEN GOTO
```


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```
320ELSE IF A$="M"THEN 40  ELSE G
OTO330
330 CLS(0):PRINT@0,"GRN\YEL\BLUE
\RED\BUF\CYAN\MAG\OR";
340 FORX=0 TO 63
350 FORY=3TO31
360 C=INT(X/8+1)
370 SET(X,Y,C)
380 NEXTY
390 NEXTX
400 A=B+2:B=B+9:IF C=8 THEN GOTO
420 ELSE GOTO340
420 LN=3:GOTO2000
500 SCREEN 0,1:CLS(0)
510 Z=INT(Z/3):IF Z<3 THEN Z=2:C
=2
520 FOR X=0TO63 STEPZ
530 FOR Y=0 TO 31 STEPZ
540 SET (X,Y,C)
550 NEXT Y:NEXT X
560 GOTO 155
599 CLS(2):GOSUB2050:PRINT@165,"
TURN DOWN COLOR CONTROL";:PRINT@
197,"FOR GREY SCALE TRACKING";:F
OR DL=1TO4000:NEXT
600 CLS(0):DATA5,2,8,7,6,1,3,4
601 S=0:D=INT(63/8)
602 FORA=1TO8
603 READ A$:C=VAL(A$)
608 FOR X=S TO D
610 FORY=0 TO 31
630 SET(X,Y,C)
640 NEXT Y
642 NEXT X:S=D:D=D+8
644 NEXT A
645 RESTORE
650 LN=4:GOTO 2000
690 CLS(4):GOSUB2060:PRINT@173,"
SELECT";:PRINT@202,"(1) CROSS MA
RKS";:PRINT@234,"(2) DOTS
";
691 A$=INKEY$:IFA$=""THEN691ELSE
 IF A$="M" THEN 40 ELSEIFA$="1"T
HEN700ELSEIFA$="2"THEN780ELSE691
700 DATA0,4,8,4,4,0,4,8
701 DATA246,4,254,4,250,0,250,8
702 DATA246,186,254,186,250,182,
250,190
703 DATA0,186,8,186,4,182,4,190
704 DATA115,91,131,91,123,83,123
,99
705 PMODE 3,1:SCREEN1,1:PCLS
710 FOR X=1TO8:READ A$:NEXT X
720 FOR A=1TO10
730 READ X1,Y1,X2,Y2
740 LINE(X1,Y1)-(X2,Y2),PSET
750 NEXTA
760 RESTORE
770 LN=5:GOTO 2000
780 CLS(0)
785 SCREEN 0,1
790 SET(1,1,5):SET(62,1,5):SET(6
2,30,5):SET(1,30,5):SET(31,15,5)
795 GOTO 770
800 CLS(8):GOSUB2060:PRINT@173,"
SELECT";:PRINT@202,"(1) CENTER C
ROSS";:PRINT@234,"(2) CENTER DOT
";
805 A$=INKEY$: IF A$="" THEN 805
ELSE IFA$="M" THEN 40  ELSE IF A
$="1" THEN 810 ELSE IFA$="2" THE
N 830 ELSE 805
810 PMODE3,1:SCREEN1,1:PCLS
815 X1=0:X2=255:X=128:Y=91:Y1=0:
Y2=192
816 LINE(X1,Y)-(X2,Y),PSET:LINE(
X,Y1)-(X,Y2),PSET
825 LN=6:GOTO 2000
830 CLS(0):X=31:Y=15
835 SET(X,Y,5) :GOTO825
900 CLS(5):GOSUB2060:PRINT@166,"
(1) HORIZONTAL BARS";:PRINT@198,
"(2) VERTICAL BARS";
910 A$=INKEY$:IF A$=""THEN 910EL
SE IF A$="M" THEN 40  ELSE IF A$
="1" THEN 980 ELSE IFA$="2" THEN
```


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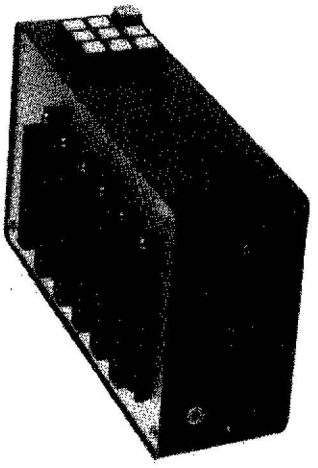
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 920 ELSE 910
920 CLS(5):PRINT@164,"COARSE(1)
OR FINE(2) BARS";
930 A$=INKEY$: IF A$="" THEN 930
 ELSE IFA$="1" THEN 940 ELSE IFA
$="2" THEN 975 ELSE 930
940 CLS(0):FOR X=0TO63STEP8:FOR
Y=1TO31
950 SET(X,Y,7)
960 NEXT Y:NEXT X
970 LN=10:GOTO 2000
975 PMODE3,1:SCREEN1,1:PCLS
976 FOR X=0TO255STEP32
977 LINE(X,0)-(X,191),PSET
978 NEXTX
979 LN=11:GOTO 2000
980 CLS(5):GOSUB2050:PRINT@164,"
COARSE(1) OR FINE(2) BARS";
990 A$=INKEY$:IF A$="" THEN 990
ELSE IF A$="1" THEN 1000 ELSE IF
 A$="2" THEN 1040 ELSE 990
1000 CLS(0):FOR Y=1TO31STEP4:FOR
X=0TO63
1010 SET(X,Y,7)
1020 NEXT X:NEXT Y
1030 LN=12:GOTO 2000
1040 PMODE 3,1:SCREEN1,1:PCLS
1050 FOR Y=0TO192STEP16
1060 LINE(0,Y)-(255,Y),PSET
1070 NEXT Y:LN=7:GOTO2000
1080 CLS(6):GOSUB2060:PRINT@166,
"(1) GUN CUTOFF ADJ";:PRINT@198,
"(2) PURITY ADJ";
1085 A$=INKEY$:IFA$=""THEN1085EL
SEIFA$="M"THEN40ELSEIFA$="1"THEN
1160ELSEIFA$="2"THEN1100
1100 CLS(0):GOSUB2050:PRINT@162,
"CHOOSE DESIRED SCREEN COLOR";:P
RINT@234,"(1) RED";:PRINT@266,"(
2) BLUE";:PRINT@298,"(3) GREEN";
1110 A$=INKEY$: IF A$="" THEN GO
TO1110ELSE IFA$="M"THEN 40 ELSE
IFA$="1" THEN 1120 ELSE IFA$="2"
 THEN 1130 ELSE IF A$="3" THEN 1
140
1120 CLS(4):GOTO 1150
1130 CLS(3):GOTO1150
1140 CLS(1):GOTO1150
1150 LN=8:GOTO 2000
1160 CLS0:PRINT@166,"ADJUST SCRE
EN CONTROLS";:PRINT@198,"UNTIL A
 WHITE LINE APPEARS";:FORT=1TO20
00:NEXT:PMODE2,1:SCREEN1,1:PCLS(
0)
1165 LINE(4,96)-(252,96),PSET
1167 LN=15:GOTO2000
1200 CLS(7):GOSUB2060:PRINT@170,
"SELECT";:PRINT@230,"(1) PINCHUS
ION";:PRINT@262,"(2) HEIGHT\WIDT
H";:PRINT@294,"(3) RS-170 TEST P
ATTERN";
1201 A$=INKEY$:IFA$="" THEN 1201
ELSE IF A$="M" THEN 40  ELSE IF
A$="1"THEN 1209 ELSE IF A$="2" T
HEN 1300 ELSE IFA$="3" THEN 1400
ELSE 1201
1209 CLS(5):GOSUB2050:PRINT@162,
"ADJUST PINCUSHION FOR BEST";:PR
INT@198,"LOOKING RECTANGLE";
1210 FOR DL=1 TO2000:NEXT
1220 PMODE3,1:SCREEN1,1:PCLS
1230 LINE(0,0)-(255,191),PSET,B
1240 LN=9:GOTO2000
1300 CLS(6):GOSUB2050:PRINT@162,
"ADJUST HORZ AND VERT HEIGHT";:P
RINT@194,"WIDTH AND LINEARITY CO
NTROLS";:PRINT@226,"TO ACHIEVE T
HE BEST CIRCLE";
1310 FORDL=1TO1500:NEXT
1320 PCLS:C=RND(4):PMODE C,1:SCR
EEN1,1
1330 FORX=5TO105 STEP5:CIRCLE(12
8,96),X,,.88:NEXT X
1340 LN=13:GOTO2000
1400 GOSUB2050:PMODE4,1:SCREEN1,
1:PCLS
1410 LINE(18,4)-(238,188),PSET,B
:LINE(18,4)-(238,188),PSET:LINE(
238,4)-(18,188),PSET
1420 CIRCLE(128,96),98,,.88:CIRC
LE(128,96),20,,.88:CIRCLE(128,96
),16,,.88:CIRCLE(128,96),10,,.88
:CIRCLE(128,96),6,,.88
1430 D=0:B=0:FORT=1TO5:LINE(18,8
4+B)-(110,94+D),PSET:LINE(238,84
+B)-(148,94+D),PSET:D=D+1:B=B+6:
NEXT
1440 D=0:B=0:FORT=1TO5:LINE(112+
B,4)-(126+D,80),PSET:LINE(112+B,
188)-(126+D,114),PSET:D=D+1:B=B+
8:NEXT
1450 LN=14:GOTO2000
2000 A$=INKEY$:IF A$="" THEN GOT
O 2000 ELSE IF A$="M" THEN 40 EL
SE GOTO 2010
2010 IFLN=1THEN70ELSEIFLN=2THEN1
60ELSEIFLN=3THEN280ELSEIFLN=4THE
N599ELSEIFLN=5THEN690ELSEIFLN=6
THEN 800 ELSE IF LN=7 THEN 900 E
LSE IF LN=8 THEN 1100 ELSE IF LN
=9 THEN 1200 ELSE IFLN=10THEN900
ELSEIFLN=11THEN900ELSEIFLN=12THE
N900
2020 IF LN=13 THEN GOTO 1200 ELS
E IF LN=14 THEN GOTO 1200ELSEIFL
N=15THEN1080
2050 L=RND(100):SOUND L,1:RETURN
2060 L=RND(100):SOUND L,3:RETURN
```

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WHAT YOU *GET* IS WHAT YOU *PUT*

By Don Inman
***Rainbow* Contributing Editor**

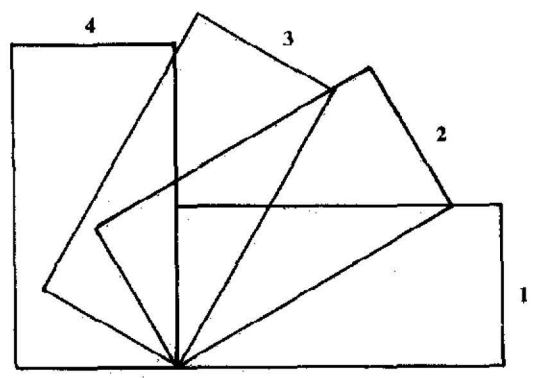
This month's article will focus on the use of some of the material of past *Rainbow* articles in order to produce moving geometric shapes. I will also use some of the techniques discussed in the book TRS-80® Color Computer Graphics (Reston Publishing Company, Inc.).

Rotating A Rectangle

The rotation of rectangles has been discussed in past *Rainbow* articles. Let's begin this month by drawing a rectangle in four different positions. Then we can progress by stages through several different methods that will produce the effect of a single rotating rectangle.

Our first program will be a simplified version of the Rotating Rectangle program that appeared in the March 1983 issue of *the Rainbow*. Each of the four rectangles will have its origin at the point 130,90. The angle of rotation will be 30 degrees or approximately 0.5236 radians. The rectangles will be drawn in the following positions.

As you run the program, notice that even though the rectangles are drawn quickly, you can see the individual lines being drawn. The program demonstrates some of the problems that must be overcome to produce the appearance of smooth motion.



Variables used in the program:

X0,Y0	point of origin for the rectangles
H	height of the rectangles
W	width of the rectangles
A	angle of rotation in radians
X1,Y1	starting point of the sides
X2,Y2	ending point of the sides

Subroutines 1000 and 2000 will be used in program versions that follow. You may want to save the program for alteration.

(Don Inman is the acknowledged master of microcomputer graphics and the author of a large number of books, including TRS-80 Color Computer Graphics and Assembly Language Graphics for the TRS-80 Color Computer with Kurt Inman.)

Rotating Rectangles — Version 1

```
99 REM SET SCREEN
100 PMODE 4,1:PCLS 1
110 COLOR 0,1:SCREEN 1,0
120 '
199 REM ASSIGN VARIABLES
200 X0=130:Y0=90:H=10:W=20
210 '
299 REM ASSIGN ROTATION ANGLE
300 FOR A=0 TO 1.5709 STEP .5236
310 X1=X0:Y1=Y0
320 GOSUB 1000
330 NEXT A
340 '
399 REM LOOP TO VIEW
400 GOTO 400
410 ' END OF MAIN PROGRAM
420 '
430 '
999 REM SET UP END POINTS
1000 X2=X1+W*COS(A)
1010 Y2=Y1-.8*W*SIN(A)
1020 GOSUB 2000
1030 X2=X1-H*SIN(A)
1040 Y2=Y1-.8*H*COS(A)
1050 GOSUB 2000
1060 X2=X1-W*COS(A)
1070 Y2=Y1+.8*W*SIN(A)
1080 GOSUB 2000
1090 X2=X0:Y2=Y0
1100 GOSUB 2000
1110 RETURN
1120 '
1999 REM DRAW LINE
2000 LINE(X1,Y1)-(X2,Y2),PSET
2010 X1=X2:Y1=Y2
2020 RETURN
```

Erase After Drawing

The next step would be the erasure of the previous rectangle as each new one is drawn. A time delay may also be necessary to keep each rectangle on the screen for a brief period before erasure. Since we have nothing on the screen except the rectangles, the simplest way to erase the rectangles is by clearing the screen. These changes could be accomplished by adding the following lines.

```
323 FOR W = 1 TO 100: NEXT W
326 PCLS 1
```

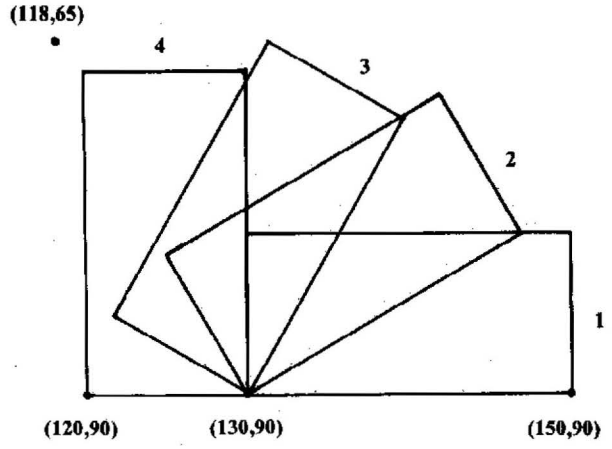
You may often have other objects on the screen that you do not want erased. Erasures of small areas can be achieved by using *GET* and *PUT* statements. You could *GET* a small area of blank screen and *PUT* it over the area that you wish to erase. It can be done by adding these lines.

```
210 DIM B(20)
323 FOR W = 1 TO 100: NEXT W
326 GET(0,0)-(32,20),B      <-- some blank area
328 PUT(118,70)-(150,90),B,PSET
```

The dimension statement for *GET*/*PUT* can be calculated by the formula:

SIZE = (LENGTH * WIDTH) / N
where N = 40 for PMODES 3 and 4
N = 80 for PMODES 1 and 2
N = 160 for PMODE 0

Even though the rectangles are only 20 by 10, they move over a larger area. Therefore, we must consider the complete area of movement.



We will use a length calculated from X=118 to X=150, or 32 units. The width is from Y=65 to Y=90, or 25 units. Plugging these numbers into the formula, we get:

SIZE = (150-118)*(90-65)/40
= 32 * 25 / 40
=20

Therefore, we can use a single dimension: DIM B(20). The values used in the *GET* and *PUT* arrays for Y is 70 rather than 65. This is possible because we are scaling Y values by 0.8 to take care of the screen distortion. This is consistent with earlier graphic articles that I have written in this series. The Y difference (90-65 = 25) will now be:

0.8 * 25 = 20

This value is then used in the *GET* and *PUT* statements as:

GET(0,0)-(32,20),B and
PUT (118,70)-(150,90),B,PSET

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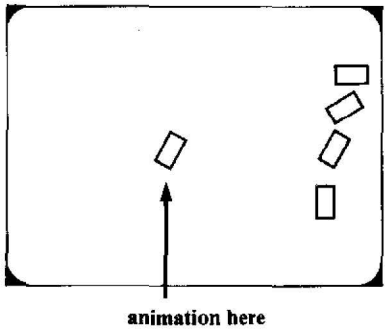
Rotating Rectangles — Version 2

```
99 REM SET SCREEN
100 PMODE 4,1:PCLS 1
110 COLOR 0,1:SCREEN 1,0
120 '
199 REM ASSIGN VARIABLES
200 X0=130:Y0=90:H=10:W=20
210 DIM B(20)
220 '
299 REM ASSIGN ROTATION ANGLE
300 FOR A=0 TO 1.5709 STEP .5236
310 X1=X0:Y1=Y0
320 GOSUB 1000                          <-- go DRAW
323 FOR Z=1 TO 100:NEXT Z
326 GET(0,0)-(32,20),B
328 PUT(118,70)-(150,90),B,PSET         <-- ERASE
330 NEXT A
340 '
399 REM LOOP TO VIEW
400 GOTO 400
410 ' END OF MAIN PROGRAM
420 '
430 '
999 REM SET UP END POINTS
1000 X2=X1+W*COS(A)
1010 Y2=Y1-.8*W*SIN(A)
1020 GOSUB 2000
1030 X2=X1-H*SIN(A)
1040 Y2=Y1-.8*H*COS(A)
1050 GOSUB 2000
1060 X2=X1-W*COS(A)
1070 Y2=Y1+.8*W*SIN(A)
1080 GOSUB 2000
1090 X2=X0:Y2=Y0
1100 GOSUB 2000
1110 RETURN
1120 '
1999 REM DRAW LINE
2000 LINE(X1,Y1)-(X2,Y2),PSET
2010 X1=X2:Y1=Y2
2020 RETURN
```

Four Rectangles To Make One

Although the rectangles rotated in the previous programs, the time needed to draw the rectangles destroyed the effect that we were trying to create. It was obvious that the rectangles were being drawn, erased, and redrawn in a new position. Let's now investigate another use of *GET* and *PUT*. Each rectangle will be drawn along the right side of the screen. Then we'll use *GET* and *PUT* to "pick off" the rectangles and move them to the center of the screen one at a time.

This version of the program will be faster because the drawings are made first. The erasure has been eliminated since each *PUT* overlays the previous rectangle. The only



time lost in the rotation at the center of the screen will be in the execution of the *GET* and *PUT* statements. The motion of the rectangle rotation will be much smoother.

Rotating Rectangles — Version 3

```
99 REM SET SCREEN
100 PMODE 4,1:PCLS 1
110 COLOR 0,1:SCREEN 1,0
120 '
199 REM ASSIGN VARIABLES
200 X0=220:Y0=30:H=10:W=20
210 DIM B(20)
220 '
299 REM FOUR POSITIONS
300 FOR A=0 TO 1.5709 STEP .5236
310 X1=X0:Y1=Y0
320 GOSUB 1000
330 Y0=Y0+30 <-- Each rectangle moved down 30 units.
340 NEXT A
350 '
399 REM ROTATE RECTANGLE
400 X=208:Y=10:GOSUB 3000
410 Y=40:GOSUB 3000
420 Y=70:GOSUB 3000
430 Y=100:GOSUB 3000
440 GOTO 400
450 ' END OF MAIN PROGRAM
460 '
470 '
999 REM SET UP END POINTS
1000 X2=X1+W*COS(A)
1010 Y2=Y1-.8*W*SIN(A)
1020 GOSUB 2000
1030 X2=X1-H*SIN(A)
1040 Y2=Y1-.8*H*COS(A)
1050 GOSUB 2000
1060 X2=X1-W*COS(A)
1070 Y2=Y1+.8*W*SIN(A)
1080 GOSUB 2000
1090 X2=X0:Y2=Y0
1100 GOSUB 2000
1110 RETURN
1120 '
1999 REM DRAW LINE
```


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(The Enchanted Forest was reviewed in the Dec. 1982 issue of Rainbow).

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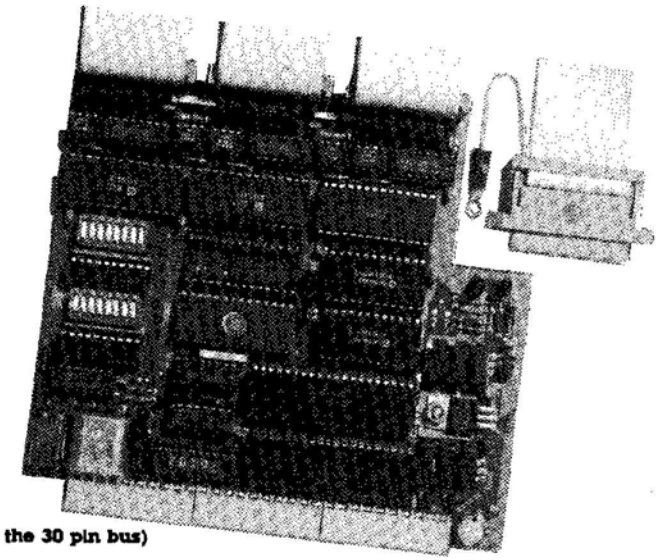
(The Game Show was reviewed in the Jan. 1983 issue of Rainbow).

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Intelligent Serial I/O Processor Board #11



(for the 30 pin bus)

The GIMIX Intelligent Three-port RS-232C Serial Interface can significantly increase the throughput of a multi-user system. By buffering data transfers between users and the system, and preprocessing the data, it reduces the number of interrupts to the host CPU, allowing the host more time for other processing tasks.

Features:

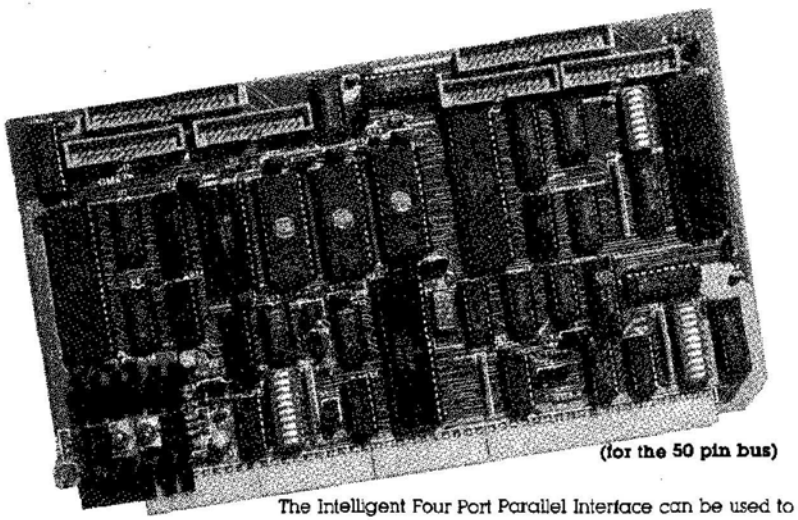
- Independent on-board 2MHz. 68B09 CPU
- Up to 20K of on-board memory (EPROM and RAM)
- Buffered data transfer between host and on-board CPUs using a Z8038 FIO with 128 byte bi-directional FIFO buffer and mailbox message capabilities.
- Three RS-232C serial I/O ports (6551As) with software selectable baud rates, word length, stop bits, and parity.
- Each port has five "handshake" lines for modem control applications.
- The on-board 6809 can be reset by the host processor.
- Compatible with memory-to-memory DMA transfers to/from the GMX 6809 CPU III.
- Sense switches and status LEDs that can be used to select software options and indicate board status.
- Separate 26-pin cable connections for each port.

Appropriate on-board firmware and operating system drivers are required. Uses up to three #95 cable sets (DB-25S connectors).

OS-9 firmware and drivers for the Intelligent 3-port Serial Interface

The OS-9 firmware and drivers enhance the performance of multi-user systems, while providing functions equivalent to the standard ACIA type drivers normally used for terminals and serial printers. Input line editing functions (backspace, echo, line dup and repeat, etc.) are handled by the I/O board, rather than the host, allowing the host more time for other processing tasks. The host is only interrupted when a complete input line (terminated by a "CR") is entered, or certain special characters are received. Input and output data are buffered on the I/O board so that the host can perform other tasks while serial data is being transmitted or received. When used with the GMX CPU III, block data transfers between the I/O board and the host use the CPUs memory-to-memory DMA to further enhance throughput. In addition to performance enhancements, features such as software selectable baud rates and transmission characteristics (number of data bits, stop bits, parity, etc.) are provided. The board also transmits "messages" to any or all I/O ports to indicate that the I/O interface is ready and "waiting for the host", and that the host is "on-line" and has opened a path to the port. Messages to individual ports can be disabled.

Intelligent Parallel I/O Processor Board #12



(for the 50 pin bus)

The Intelligent Four Port Parallel Interface can be used to improve system performance by buffering data transfers to parallel peripherals such as printers and/or by buffering and pre-processing parallel input data from keyboards, sensors, etc.

Features:

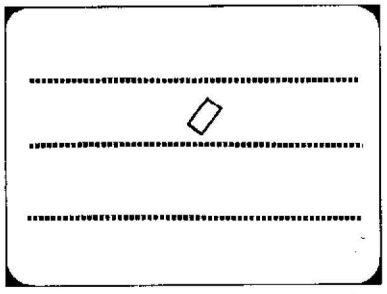
- Independent on-board 2MHz 68B09 CPU
- Up to 32K of on-board memory (EPROM and RAM)
- Buffered data transfer between host and on-board CPUs using a Z8038 FIO with 128 byte bi-directional FIFO buffer and mailbox message capabilities.
- Four fully buffered 8-bit parallel ports with handshaking and input/output latches (two 6522 VIAs). Each 6522 also has two 16-bit counter/timers and a shift register for serial data transfers.
- Software programmable direction for each bit on two of the four ports (1 per VIA), the other 2 ports can be individually programmed as 8 in or 8 out. The bi-directional handshake lines can be programmed as inputs or outputs.
- The on-board 6809 can be reset by the host processor.
- Full 20-bit address decoding; it can be addressed on any 4 byte boundary in 1M byte of address space.
- Compatible with memory-to-memory DMA transfers to/from the GMX 6809 CPU III.

Appropriate on-board firmware and operating system drivers are required. Uses up to four #95 cable sets (DB-25P connectors) or two 36-pin cable sets with Centronics compatible connectors. Centronics compatible cable sets include a back panel connector plate for the Classy Chassis. Back panel to printer cables are also available.

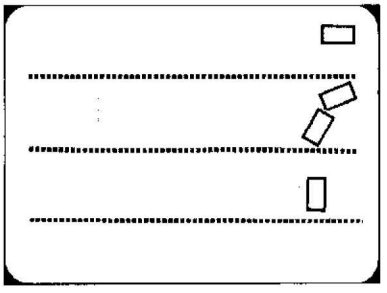
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```
2000 LINE(X1,Y1)-(X2,Y2),PSET
2010 X1=X2:Y1=Y2
2020 RETURN
2030 '
2999 REM GET AND PUT
3000 GET(X,Y)-(X+32,Y+20),B,G
3010 PUT(118,70)-(150,90),B,PSET
3020 RETURN
```

Now that you see how *GET* and *PUT* statements work, you can eliminate the four rectangles on the right side of the screen and place them on pages of memory that will not be shown. Since we are working in *PMODE 4,* four pages of memory are used to fill up the display screen. Eight pages of memory are needed for two screens.



Turn on these Pages for Rotating



Use these Pages to Store Four Rectangles

You can change two lines and add one line to draw the four rectangles on the unseen pages. Lines 100 and 110 are changed and line 120 is added.

```
100 PCLEAR 8        <- we need all 8 pages
110 PMODE 4,5: PCLS 1   <- clear pages 5-8
120 COLOR 0,1       <- (DO NOT turn on screen here)
```

Line 350 is added to clear the first four pages of memory.

```
350 PMODE 4,1: PCLS 1
```

To *GET* rectangles from pages 5-8 and *PUT* them on pages 1-4, the *GET* and *PUT* subroutine is changed to:

```
2999 REM GET AND PUT
3000 PMODE 4,5          <= GET from pages 5-8
3010 GET(X,Y)-(X+32,Y+20),B,G   <- notice G is added to get detail
3020 PMODE 4,1: SCREEN 1,0      <- TURN ON pages 1-4
3030 PUT(118,70)-(150,90),B,PSET   <- PUT pages 1-4
3050 RETURN
```

The complete fourth version using the above changes follows. The rotation now takes place smoothly, and no one would know about the rectangles on the unseen screen. What you *GET* is what you *PUT.*

Rotating Rectanges — Version 4

```
99 REM SET SCREEN
100 PCLEAR 8
110 PMODE 4,5: PCLS 1
120 COLOR 0,1
130 '
199 REM ASSIGN VARIABLES
200 X0=220:Y0=30:H=10:W=20
210 DIM B(20)
220 '
299 REM FOUR POSITIONS
300 FOR A=0 TO 1.5709 STEP .5236
310 X1=X0:Y1=Y0
320 GOSUB 1000
330 Y0=Y0+30
340 NEXT A
350 PMODE 4,1:PCLS 1
360 '
399 REM ROTATE RECTANGLE
400 X=208:Y=10:GOSUB 3000
410 Y=40:GOSUB 3000
420 Y=70:GOSUB 3000
430 Y=100:GOSUB 3000
440 GOTO 400
450 ' END OF PROGRAM
460 '
470 '
999 REM SET UP END POINTS
1000 X2=X1+W*COS(A)
1010 Y2=Y1-.8*W*SIN(A)
1020 GOSUB 2000
1030 X2=X1-H*SIN(A)
1040 Y2=Y1-.8*H*COS(A)
1050 GOSUB 2000
1060 X2=X1-W*COS(A)
1070 Y2=Y1+.8*W*SIN(A)
1080 GOSUB 2000
1090 X2=X0:Y2=Y0
1100 GOSUB 2000
1110 RETURN
1120 '
1999 REM DRAW LINE
2000 LINE(X1,Y1)-(X2,Y2),PSET
2010 X1=X2:Y1=Y2
2020 RETURN
2030 '
2999 REM GET AND PUT          <- GET from pages 5-8
3000 PMODE 4,5
3010 GET(X,Y)-(X+32,Y+20),B,G
3020 PMODE 4,1:SCREEN 1,0
3030 PUT(118,70)-(150,90),B,PSET
3040 RETURN                   <- PUT on pages 1-4
```

An Application

The final step in any educational experience is the application of what you have learned to some practical objective. Suppose you needed to display a clock in order to time some event. The rectangle could be narrowed to dimensions of 2 by 20. You could then rotate the rectangle to simulate the movement of a time clock.

In the previous programs we have rotated through 90 degrees with four different rectangle positions. This must be extended to 360 degrees of rotation for the clock simulation. We will handle the rotation as before except that we need a clockwise rotation and 12 different positions. We also need a circle to represent the face of the clock.

Version 4 of Rotating Rectangles will serve as the basis for the clock program with these changes and additions.

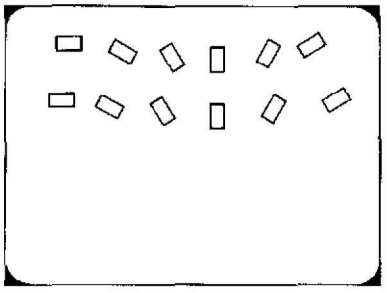
```
                                  ← X0, Y0 and H changed
200 X0=20:Y0=30:H=2:W=20
210 DIM B(40)                     ← dimension extended

                                  ← this section changed
299 REM FOUR POSITIONS              to draw 12 positions
300 FOR A=6.2832 TO 3.6651 STEP
-.5236
310 X1=X0:Y1=Y0
320 GOSUB 1000                    ← 6 positions — top row
325 X0=X0+40
330 NEXT A
335 X0=20:Y0=80
340 FOR A=3.1416 TO .5235 STEP -
.5236
345 X1=X0:Y1=Y0
350 GOSUB 1000                    ← 6 positions — bottom row
355 X0=X0+40
360 NEXT A
370 PMODE 4,1:PCLS 1
380 CIRCLE(125,90),30,0,.8        ← add clock face
390 '
399 REM ROTATE RECTANGLE          ← this section changed for 360 degree rotation
400 X=0: Y=16
410 FOR N=1 TO 6
420 GOSUB 3000
430 X=X+40
440 NEXT N
450 X=0: Y=64
460 FOR N=1 TO 6
470 GOSUB 3000
480 X=X+40
490 NEXT N
500 GOTO 400
510 ' END OF MAIN PROGRAM

                                  ← area enlarged
3010 GET(X,Y)-(X+40,Y+32),B,G

3030 PUT(106,74)-(146,106),B,PSE
T
```

Pages 5-8 of graphic memory will hold these 12 positions.

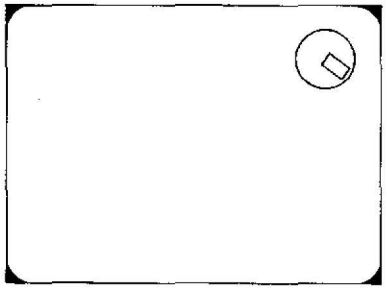


The *FOR-NEXT* loop beginning at line 410 will pick off the top row of rectangles, one at a time, and display them near the center of the screen. The *FOR-NEXT* loop beginning at line 460 will do the same thing for the second row of rectangles.

The clock could be moved to any part of the screen by simply changing the *PUT* statement at line 3030. If you move it, be sure to keep the *PUT* dimensions the same size as the *GET* dimensions. Also, move the circle in line 380.

Example: 3030 PUT(206,16)-(246,48),B,PSET
380 CIRCLE(225,32),30,0,.8

The clock will now appear in the upper right corner of the screen.

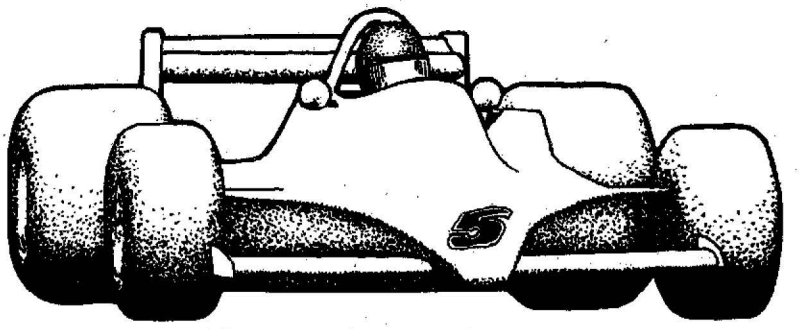


If you wish to slow the rate of rotation, put a time delay in the *GET* and *PUT* subroutine following the *PUT* statement.

Clock

```
99 REM SET SCREEN
100 PCLEAR 8
110 PMODE 4,5: PCLS 1
120 COLOR 0,1
130 '
199 REM ASSIGN VARIABLES
200 X0=20:Y0=30:H=2:W=20
210 DIM B(40)
220 '
299 REM FOUR POSITIONS
300 FOR A=6.2832 TO 3.6651 STEP
-.5236
310 X1=X0:Y1=Y0
```

YOUR COLOR COMPUTER JUST GOT WHEELS!



REVOLUTION!

You accelerate hard down a long straightaway, braking heavily at the end for a hard corner. You slice smoothly through the esses, and then boldly keep the power on for a fast sweeper. The Ferrari drifts dangerously near the edge, but you make a tiny correction in the steering, and you are through.

The finish line flashes by, and suddenly you are in the pits. The car falls silent. You see your lap times being held up. Your final lap was a new lap record! At last, you permit yourself a small smile.

You have mastered this powerful car on a difficult track, driving with the assurance and precision that comes only from long hours of practice.

You are driving an *authentic* race car. You are playing *Revolution!*

FANTASTIC ACTION

Revolution uses high resolution, machine language graphics for action that is smooth and fast. The emphasis is on authenticity in the control and motion of your car. As in driving a real race car, accuracy and precision in your driving are what counts. Frills and non-essentials have been left out.

PURE COMPETITION

Like a real race driver in practice and qualifying sessions, you compete against the clock and against the existing lap record for that track. *Revolution* records the lap records and the name of the person who set the record, so you always know who reigns supreme on your favorite track!

DESIGNED WITH YOU IN MIND

Revolution is menu-driven, and self explanatory. Information screens tell you what you need to know. When you're ready to play, a menu of the names of all your tracks is displayed, along with the lap record for each track and the name of the person who set that lap record. You select a track with a single keystroke, and *Revolution* takes you there.

A NEW CONCEPT

Revolution is a unique game, because it allows you to create the most important part of any race game: the track itself.

The first time you run *Revolution,* you will be able to choose from several tracks and cars which are included with the game.

But, with *Revolution,* this is only the beginning! You can create as many tracks as you like. You can make each new track as difficult or as easy as you wish. You can make easy ones to begin with, and tougher ones as you become more skilled. You may find creating tracks to be almost as much fun as driving on them!

You can save your favorite tracks to run on again whenever you wish. *Revolution* will automatically add these new tracks to the menu. And you can exchange your favorite tracks with other *Revolution* owners.

Be careful, though, about letting your friends play this game. They may not want to let you have your computer back!

THE EARLY *REVOLUTION*

A prototype version of *Revolution* was published in the September, 1982 issue of Rainbow magazine, under the name *The Track.* The response to *The Track* has been terrific.

Revolution has all the features that have made *The Track* a favorite, and *Revolution*'s fast, high-resolution machine language graphics are dramatically improved over the prototype's.

REVOLUTION NOW!

The original *Revolution* for the TRS-80™ Color Computer requires 32K and one disk drive. A new cassette version has action just like the disk version, and similar track-saving features excluding a menu of available tracks. The cassette version will run on a 32K Color Computer or TDP-100. You can upgrade to the disk version later, too, for a nominal fee.

REVOLUTION		
For 32K Disk	**$24.95**	*Requires Joysticks*
For 32K Cassette . . .	**$21.95**	*& Extended BASIC*

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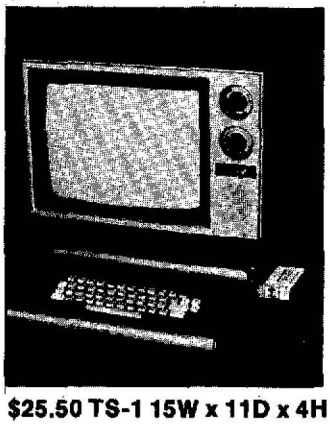
```
320 GOSUB 1000
325 X0=X0+40
330 NEXT A
335 X0=20:Y0=80
340 FOR A=3.1416 TO .5235 STEP -
.5236
345 X1=X0:Y1=Y0
350 GOSUB 1000
355 X0=X0+40
360 NEXT A
370 PMODE 4,1:PCLS 1
380 CIRCLE(125,90),30,0,.8
390 '
399 REM ROTATE RECTANGLE
400 X=0: Y=16
410 FOR N=1 TO 6
420 GOSUB 3000
430 X=X+40
440 NEXT N
450 X=0: Y=64
460 FOR N=1 TO 6
470 GOSUB 3000
480 X=X+40
490 NEXT N
500 GOTO 400
510 ' END OF MAIN PROGRAM
520 '
530 '
999 REM SET UP END POINTS
1000 X2=X1+W*COS(A)
1010 Y2=Y1-.8*W*SIN(A)
1020 GOSUB 2000
1030 X2=X1-H*SIN(A)
1040 Y2=Y1-.8*H*COS(A)
1050 GOSUB 2000
1060 X2=X1-W*COS(A)
1070 Y2=Y1+.8*W*SIN(A)
1080 GOSUB 2000
1090 X2=X0:Y2=Y0
1100 GOSUB 2000
1110 RETURN
1120 '
1999 REM DRAW LINE
2000 LINE(X1,Y1)-(X2,Y2),PSET
2010 X1=X2:Y1=Y2
2020 RETURN
2030 '
2999 REM GET AND PUT
3000 PMODE 4,5
3010 GET(X,Y)-(X+40,Y+32),B,G
3020 PMODE 4,1:SCREEN 1,0
3030 PUT(106,74)-(146,106),B,PSE
T
3040 RETURN
```


for 13" TV

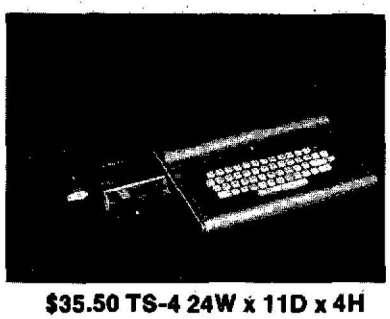
MONITOR (TV) STANDS

for 19" TV

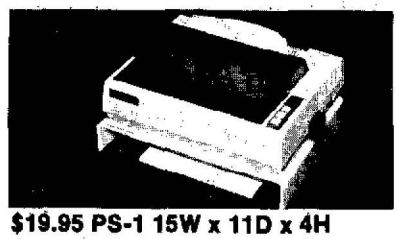
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32K
MACHINE
LANGUAGE

Tidying Up Your Text

By Joseph Kolar

Rainbow Contributing Editor

This article is addressed to the newcomer to computing, but anyone may benefit.

Being the nature of the beast, the color computer is a visual delight. However, too often an otherwise well designed program suffers from lackluster presentation of text. This, and the next article, will help you create neat, well centered text.

"The object . . . is to introduce a few ideas to assist the newcomer to computing to create neater, well planned and centered text that will be visually attractive."

Lots of good programs lose a lot of their impact due to sloppy and thoughtless presentation of text. How often have you seen a few lines of instructions or input requests jammed up into the upper left-hand corner of the display screen, which give a poor visual presentation and defy the laws of centering?

The object, therefore, is to introduce a few ideas to assist the newcomer to computing to create neater, well planned and centered text that will be visually attractive.

First, let us create a simple title page. We want the text on the page to be centered horizontally as well as vertically.

Key in line:

```
100 GOTO 100
```

(Joseph Kolar is a free-lance writer and programmer dedicated to proselytizing for computers in general, and the CoCo specifically.)

This continuous loop will keep the display on the screen so you can *RUN* your program as often as you like to check your progress. It is good policy to keep a "hold display" line just before the balance of your program, because titles are generally written after a program is completed.

Key in:

```
10 FOR I=1 TO 3:PRINT:NEXT 'THIS LINE WILL
    GIVE YOU 3 BLANK ROWS ON TOP OF
    SCREEN.
20 PRINT TAB(9)"RAINBOW IDEAS"'THIS WILL
    CENTER THE TITLE. RUN IT.
30 PRINT TAB (10)"YOUR NAME" ' THIS WILL
    CENTER YOUR NAME. RUN IT.
```

You will notice that it isn't properly centered. It should be more to the left. Change the "8" to a number you think it should be. *RUN* it. Keep running and changing the number until you are satisfied with the centering.

```
40 PRINT TAB(8)"YOUR TOWN AND STATE"
    'ADJUST IT BY CHANGING THE NUMBER,
    IF NECESSARY. WHEN YOU HAVE THE 3
    LINES NEATLY CENTERED, YOU WILL NO-
    TICE THAT THE TITLE IS TOO HIGH ON
    THE SCREEN. CHANGE THE 3 TO A 5 IN
    LINE 10. THIS WILL ADD TO MORE PRINT'S
    TO LINE 10.
```

Look at your handiwork. If you just want a three line title, *BREAK, LIST.* List the routine in your notebook or on a sheet of paper.

```
10 FOR I=1 TO 5:PRINT:NEXT
20 PRINT TAB( )"  "
30 PRINT TAB(11)"YOUR NAME"
40 PRINT TAB(6)"YOUR TOWN AND STATE"
100 GOTO 100 'TEMPORARY LINE UNTIL TITLE
    IS FINALIZED.
```

This format will always be the same. Substitute your name and address in lines 30 and 40 and put in the appropriate numbers. Line 20, the title, will always be different so the position is unknown.

FHS Federal Hill Software

FINE PRODUCTS FOR THE COLOR COMPUTER AND TDP-100

The Handicapper

Use the power of you Color Computer to improve your performance at the track! The Handicapper is two separate programs for thoroughbred and harness horses that apply sound handicapping techniques to produce rankings for the horses in each race. Factors include speed, distance, track condition, post position, past performance, jockey or driver's record and other attributes. With a little practice, you can handicap an entire race in a few minutes and a whole card in less than an hour! Easy enough for the beginner, sophisticated enough for the veteran horseplayer. Cassette comes with both Extended and Standard Basic versions (the only difference is in the graphics). Includes complete documentation and betting guide. Thoughred or Harness Handicapper, $24.95 each on tape. $29.95 disk. Both programs only $39.95 tape or disk.

Coco-Accountant

Were your taxes a mess this year? Let Coco-Accountant keep track of your finances and make those deductions a breeze! Using data from canceled checks, Coco-Accountant lists and totals expenses by month, account or payee. It provides a year-to-date summary by account, sorts checks by date, lists to screen or printer and saves data on tape or disk. In addition, 32K version flags tax deductible checks and checks subject to sales tax. It even computes the sales tax you paid, afeature that can pay for the program when deduction time rolls around. Disk version has even more features. There's nothing like this anywhere at the price! 16K handles 200 entries, 32K Up to 450. RequiresExt. Bas. Only $15.95 on tape, $21.95 on disk.

Printer Artist

This unique printer utility introduces the Color Computer to the little known but delightful craft called "Artyping." This is the art of creating pictures using typewritten characters, and Printer Artist puts it at your fingertips. It includes two programs with 12 ready-to-run drawings of of ships, birds and animals, holiday and patriotic themes, famous Americans and more. In addition, there are two utility programs and instructions for 40 additional drawings. Create your own file of printer art and save it to tape or disk. Complete documentation. Fun for home or classroom. Only $19.95 on tape, $24.95 on disk. Requires Ext. Bas.

Play Blackjaq!

This is as close as you can come to the real thing without using your shirt. A full casino simulation, with up to 5 players and 9 decks. The computer plays vacant hands by card counting rules, keeps track of everybody's winnings and losings, displays two card-counting algorithms and even prints out the results of every hand if a printer is on line! Joystick option for two players. Great for the beginner or experienced player. Use it at home for fun or brush up on your technique before hitting Atlantic City or Las Vegas. Requires 16K, Ext. Bas. Only $19.95 on tape, $24.95 on disk.

64K Breakthrough!

Did you feel gypped when you found out your "64K" computer still had the same old 32K in Basic? We sure did. So we've developed HID 'N RAM, a program that will access that "hidden" 32K from basic and use it for data storage. Imagine writing a 28K data handling program with every bell and whistle you can think up and still having 32K left for the names, numbers and addresses you're crunching! This isn't one of those arcane 64K "DOS" programs that machine language lovers love to brag about. It's a brief ML driver embedded in a Basic demonstration program that shows you how to store your data in the "other" 32K and access it using regular Basic commands. When you see how it works, you can delete our program and write your own. The ML driver stays with the program! Use it from tape or disk. So what's the catch? There's only one. Your data must be in strings of equal length—which the program takes care of—and that length must be a power of 2 (such as 4, 8, 16, 32 or 64 bytes). And, of course, you must have a 64K computer. That's it. Comes with complete documentation. HID 'N RAM is only $19.95 on tape, $24.95 on disk.

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Now two exciting programs can make your Color Computer talk using digitally recordedhuman voice. No expensive hardware necessary! Hearing is believing!

TALK PROCESSOR:Quick and easy to use! No programming required. Just type in two-letter commands to produce hundreds of statements in three different voices. 26-word vocabulary. Great fun for kids! Requires 16K Ext. Basic. Only$19.95.

ADD-A-VOICE: This 4K machine language utility adds a new dimension to your game and quiz programs. Generate digitized human speech with just a few simple Basic commands. 25 words in all, easy to use. Specify 16K or 32K. Does not require Ext. Bas. Just $19.95.

SPECIAL!—Order TALK PROCESSOR and ADD-A-VOICE for only $29.95.

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To order programs, send check or money order to FEDERAL HILL SOFTWARE, 825 William St., Baltimore, MD 21230. Your personal check is welcome—no delays. Add $1.50 per order for postage and handling.

To make a new title page, just copy the lines. Guesstimate the tab number and key in your title name. Keep all the lines! Then *CLEAR, RUN,* and if it is off center, move it by changing the number until you are pleased with the result. Before long, as you keep using this technique, you will commit to memory the routine and the tab numbers for your name and address. There is nothing to prevent you from adding more lines to the title. Make sure you center it horizontally and then vertically.

You may center by the guesstimate system or do it the exact way, as follows:

1) Count the letters in your title. If you get an odd number for the total, add 1 to the result.
2) Divide the result by 2.
3) Subtract the result from 16 to get the tab number.

After making a few title pages, use the system you prefer and you will create attractive title pages.

We have to get rid of line 100 and replace it with something else or the program will never be seen.

One way would be to have a time delay to allow adequate time to read and absorb the contents of the title before continuing. Delete line 100 and key in:

```
50 FOR Z= 1 TO 1000:NEXT 'ROUGHLY EACH IS
     EQUIVALENT TO 2 SECONDS. RUN IT.
```

You will get an "OK" when the time (1000) is up. Was that enough time? Change the 1000 to 2000 and *RUN* it. If you would like more time, change it to a higher number until you are satisfied that it is just right to read and absorb the message of the title. Never make it overly long because the reader will become impatient.

Write line 50 in your notebook and refer to it until you memorize it and its significance. Note that it isn't necessary to add "Z" after next, since the computer understands that the next refers to the time waster "Z."

Another way to move on is as follows:

Delete line 50 and key in

```
50 PRINT:PRINT
60 PRINT:INPUT"TO CONTINUE, PRESS
     ENTER";01'
```

We skipped three lines below your title via *PRINT* and added line 60 to exit the page. *RUN* it. Notice how it looks a little odd butted up to the left margin? Correct this defect by inserting two "spaces" after the first quotation mark.

That's better! In fact, make it an operating procedure to always start with two spaces when you input. If you think the input statement would look better if it were lower, add a ":*PRINT*" to line 50. If you like that better, leave it. If you liked it the other way, lop off the last "*PRINT*" from line 50.

Now copy lines 50 and 60 in your notebook for reference. You will use it exactly as it is listed many, many times.

You may want to use the short form. If so, change line 60 to read:

```
60 PRINT:INPUT" PRESS ENTER";01
```

RUN it. Did you leave two spaces after the first quotation mark? If you would rather have it more to the right, just change the number of spaces to seven or eight instead of two. Either way, it looks good. Note the *PRINT* in line 60. It always looks better if you skip a row between previous lines and the *INPUT* statement.

Where do we go when you press *ENTER*? To the next page! If you do not have a new page key in:

```
70 CLS:PRINT:PRINT ' THIS CLEARS AWAY
     THE TITLE PAGE AND SKIPS 2 LINES.
```

If you are printing text, you would skip one line, and after the second *PRINT,* add a quotation mark and two spaces.

Back to the title page! *CLEAR, RUN.* Suppose you want to write a short statement under your title? *LIST, ENTER.* Change line 50. Instead of skipping two rows, we will skip one line and use the second *PRINT* to begin our new paragraph.

```
50 PRINT:PRINT" THE RAINBOW MAGAZINE
     IS THE"
52 PRINT"BEST MAGAZINE FOR NEWCOMERS
     TO"
54 PRINT"THE WORLD OF COLOR COMPUT-
     ING."
```

RUN it.

It looks neat and centered horizontally but it looks a bit off in the vertical direction. *LIST*-50. First, knock off a few of the blank rows from the top of the screen by changing the 5 to a 3 in line 10. *RUN* it and see what you have. That looks good! Maybe, we ought to move that "press enter" line down one row so it doesn't look like part of the paragraph. *LIST* and *ENTER.*

We can do one of three things:

1) Add ":PRINT" to line 56
2) Insert line 58:
   58 PRINT
3) Insert "PRINT:" before or after "PRINT" in line 60.

Take your choice! Notice that line 52 has two spaces to start a sentence, but that lines 54 and 56 butt right up to the left margin because they are a continuation of a sentence.

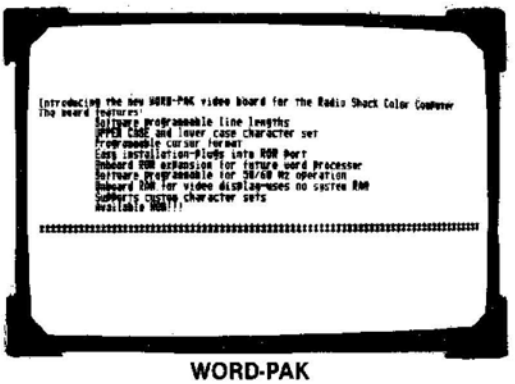
RUN your program one more time! Isn't that pretty good?

In the next article we will show you a better way to write lines 50 through 54.

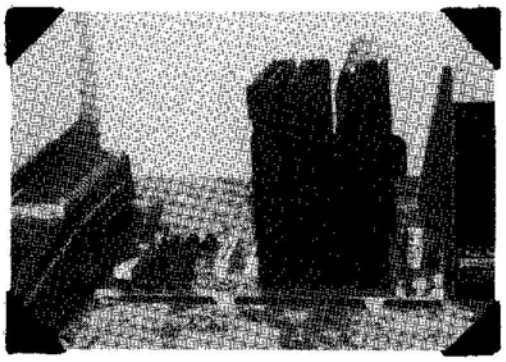
I hope you had fun and learned a lot!



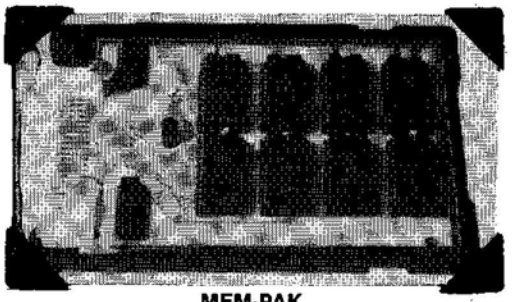
CoCo ALBUM



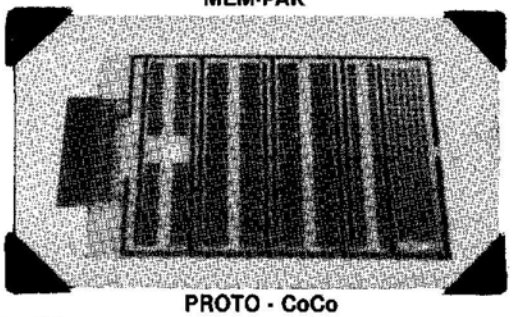
WORD-PAK
DISPLAY



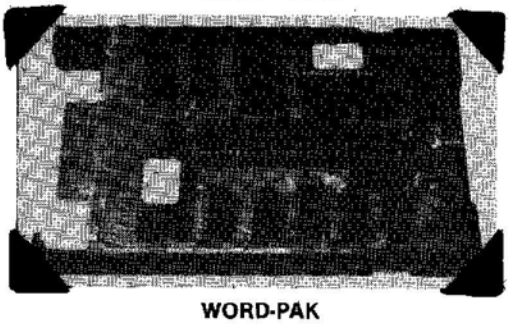
C-C BUS INSTALLED



MEM-PAK



PROTO - CoCo



WORD-PAK

WORD-PAK

80 column video board for the Radio Shack Color Computer. No longer do you have to sacrifice valuable memory and strained eyesight to expand the video display of your computer. The board features:

- Full ASCII character set (also supports custom character sets for user specific applications)
- Programmable line lengths and cursor formats
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- 50/60Hz operation
- Easy installation-plugs into ROM port
- Available for cassette or disk based systems (disk systems require the use of a 'Y' connector or expansion bus)
- Contains it's own video RAM-requires no system RAM

The WORD-PAK produces a composite video signal and requires the use of a monitor capable of displaying 80 columns of text.

Think of the applications!!

Price: $169.95

MEM-PAK

16K RAM/ROM expansion board. Expand RAM (for unmodified Rev. E and older computers) or put your programs/utilities in ROM for instant loading. Utilizes 24 pin, compatible RAM/ROM/EPROM memory devices.

Price: $114.00 (with 16K RAM)

P-C PAK

Parallel printer port and real time clock. Free up your serial port by adding this Centronics compatible parallel port to your computer. The board also features a real-time clock with battery back-up capability (optional).

Price: $122.95

C-C BUS

A fully buffered, six slot expansion bus for your CoCo. Each slot is software selectable, allowing up to six cartridges/accessory boards to be installed simultaneously with no contention problems. The bus also supports boards designed to use the high memory (HFF60-FFBF) area as I/O. Simply connect the C-C BUS to the ROM port** and you can expand memory (up to 128K for Rev E and older computers that can 'write' to the ROM port), add a parallel port, EPROM programmer, voice synthesizer.... you name it, and software select the one you want to use without having to turn the computer off to change cartridges.

Think of the potential!!

Price: $125.00

Option 1. **Power supply** **$24.95**
The C-C BUS can use either the computers power supply (this will limit the number of devices you can install on the bus) or an on-board power supply.

Option 2. **Molded plastic cover** **$Call**

**** Requires S-cable (below)**

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SPECIAL:

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Bloc Head Requires Skill, Concentration

After pumping more quarters than I care to mention into the arcade game, *Q-Bert*, I came across a Color Computer version called *Bloc Head*. After *CLOADMing* the game into my computer, I realized that it was very similar to the popular game that I had been enjoying for the past couple of months, spending lots of time and money on in the local arcade. Perhaps I was the "Bloc Head" for not discovering the home version sooner, but, at any rate, the game is addictive.

Bloc Head is a little, black, egg-shaped character with extended arms and legs. He sort of looks like Humpty Dumpty with bright green eyes and a glowing smile. The objective for this cute little creature is to change the color of the 27 cubes to the color indicated in the upper right corner of the screen. This is done simply by jumping from cube to cube, without going off the edge, in order to score as many points as possible. Each cube the *Bloc Head* successfully jumps on scores 25 points. Sounds easy, right? —Wrong!

Aside from the problem of getting accustomed to the direction of the joystick, there are also a number of strange monsters destined to destroy you as you are jumping on the cubes. Skill and concentration are required in order to achieve the objective.

The monsters of the game can either be rewarding or dangerous. The "Blue Egg" or the "Oops" monsters can be destroyed by jumping on them for 100 points. The additional colored monsters are deadly and should be avoided whenever possible. When the black monster reaches the bottom of the screen, he changes into "the Spring" which is the deadliest monster of all. You must then try to persuade him to chase you towards the "blinking bus stops," which are located at the bottom of the screen. If "Spring" is following close enough behind you, as you jump on the bus stop, he will try to follow you, but will instead fall to his death, as the bus stop transports you back to the top of the screen. If this is done successfully, it is worth 500 points. Although I killed "Spring," at the same time, another monster was coming out of the top of the cubes, setting out to destroy me all over again. When all the cubes are changed, the award is 2500 bonus points and a new wave begins.

I found that it is a good idea to get familiar with the playing screen during the first two screens because the third screen is invisible at the beginning. The 27 blocks are unseen, and, when you jump on them the color and the block appear. A box in the upper right corner tells you how many blocks you have changed—if you have time to notice. This was the toughest and most challenging level of the game. I have only been able to play the invisible screen twice, because my skills did not allow me to go further than the first two screens.

Bloc Head has two skill levels, either EASY or TUFF. The only difference I found is that the TUFF level has extra monsters chasing you. You start the game with four Bloc Heads and an extra one is provided for every 10,000 points you accumulate. The game is over when you lose your last Bloc Head.

The instruction sheet is very informative and easy to understand. *Bloc Head* features good quality graphics and sound effects. The visual effects are great, too. I really felt as if the monsters were chasing me, so I became determined to "trick them off the edge." It takes a lot of practice for one to get used to the joystick. I "committed suicide" a number of times by making just one wrong move and falling off the edge, but after playing several times, I finally got the maneuvering of the joystick down pat.

Bloc Head requires 16K and one joystick, although you may need two—just in case the first one wears out. I highly recommend this game for both children and adults who want to put their skills to a test. Personally, there is no other computer game I have become more addicted to. *Bloc Head* is a very enjoyable game—and best of all—you don't need quarters!

(Computerware, Box 668, Encinitas, CA 92024, tape $26.95, disk $29.95 + $2 S&H)

—Jutta Kapfhammer

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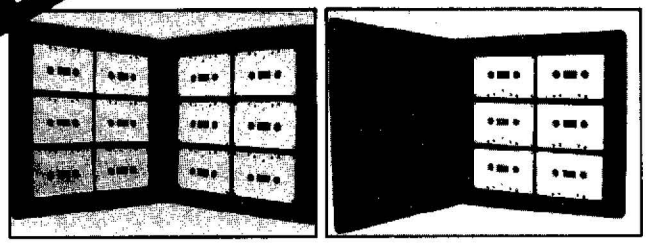
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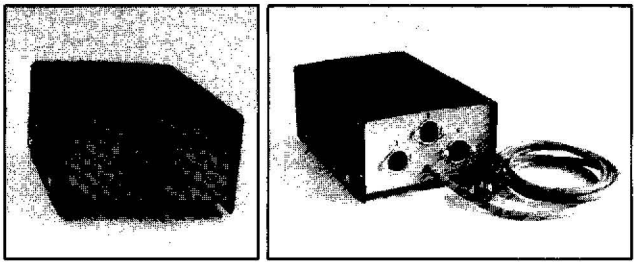


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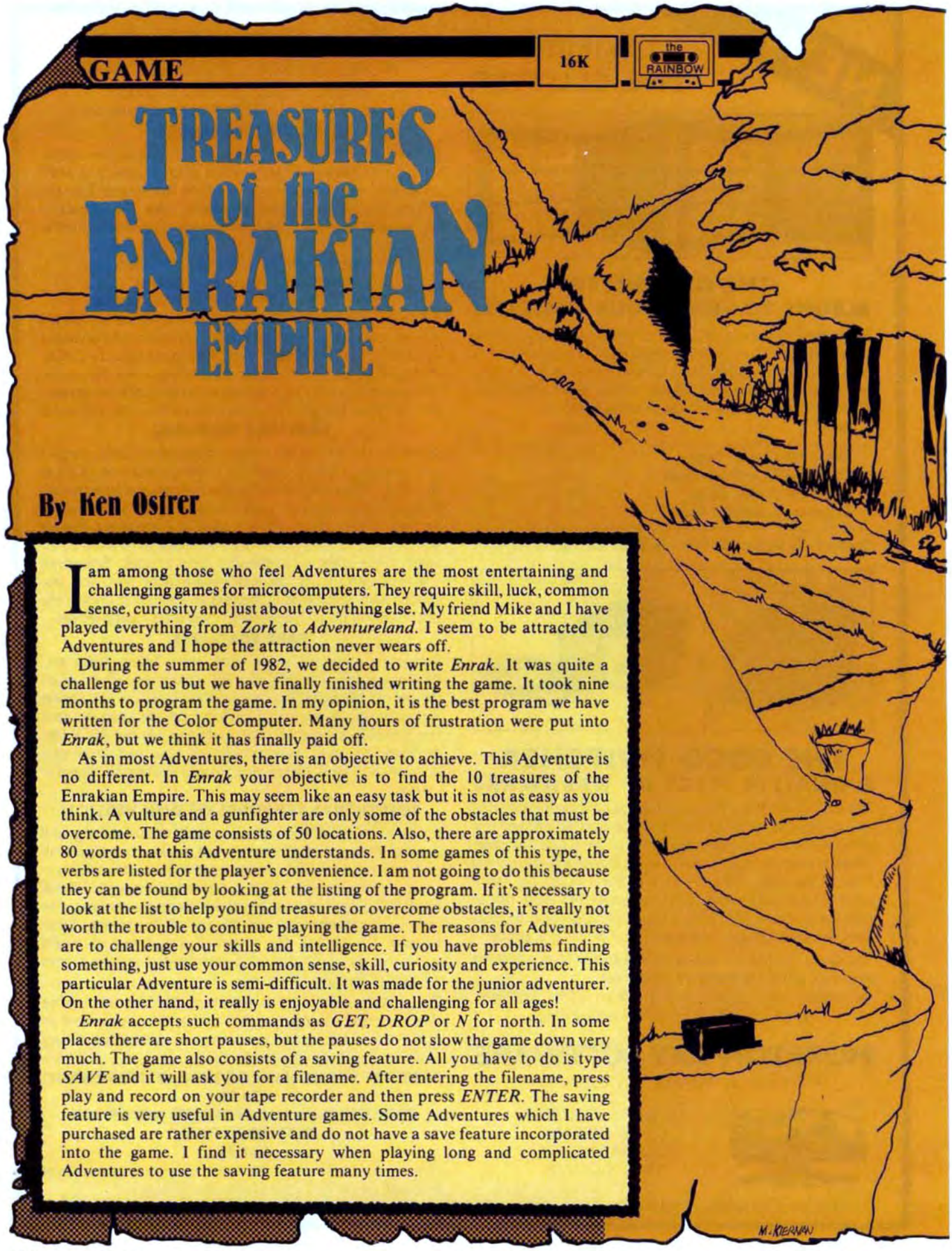
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GAME

16K

the RAINBOW

TREASURES of the ENRAKIAN EMPIRE



By Ken Ostrer

I am among those who feel Adventures are the most entertaining and challenging games for microcomputers. They require skill, luck, common sense, curiosity and just about everything else. My friend Mike and I have played everything from *Zork* to *Adventureland*. I seem to be attracted to Adventures and I hope the attraction never wears off.

During the summer of 1982, we decided to write *Enrak*. It was quite a challenge for us but we have finally finished writing the game. It took nine months to program the game. In my opinion, it is the best program we have written for the Color Computer. Many hours of frustration were put into *Enrak*, but we think it has finally paid off.

As in most Adventures, there is an objective to achieve. This Adventure is no different. In *Enrak* your objective is to find the 10 treasures of the Enrakian Empire. This may seem like an easy task but it is not as easy as you think. A vulture and a gunfighter are only some of the obstacles that must be overcome. The game consists of 50 locations. Also, there are approximately 80 words that this Adventure understands. In some games of this type, the verbs are listed for the player's convenience. I am not going to do this because they can be found by looking at the listing of the program. If it's necessary to look at the list to help you find treasures or overcome obstacles, it's really not worth the trouble to continue playing the game. The reasons for Adventures are to challenge your skills and intelligence. If you have problems finding something, just use your common sense, skill, curiosity and experience. This particular Adventure is semi-difficult. It was made for the junior adventurer. On the other hand, it really is enjoyable and challenging for all ages!

Enrak accepts such commands as *GET, DROP* or *N* for north. In some places there are short pauses, but the pauses do not slow the game down very much. The game also consists of a saving feature. All you have to do is type *SAVE* and it will ask you for a filename. After entering the filename, press play and record on your tape recorder and then press *ENTER*. The saving feature is very useful in Adventure games. Some Adventures which I have purchased are rather expensive and do not have a save feature incorporated into the game. I find it necessary when playing long and complicated Adventures to use the saving feature many times.



This game takes nearly all of my 16K. Adjusting or separating lines will bring nothing but trouble for you. This program has been debugged and played many times. The chance of an error arising in it is very slim. Mike and I wanted to add more rooms, tricks and traps but memory limitations would not permit us to do these things. Anyone who has 32K out there is extremely lucky!

If you would like the words to appear on the screen slower *POKE* 359,60, and to escape this mode *POKE* 359,0. This seems to add a nice touch to the program. If a friend happens to come over and wants to play this Adventure, it would be nice to stop him or her from looking at the listing of the program. If you would like the program to stop listing *POKE* 383,158. Some numbers may appear on the screen when you type *LIST*, but this is no problem. To escape this mode *POKE* 383,0.

We hope this program is as enjoyable for you to play as it was for us to program. If you would like help with this game, please write: Ken Ostrer, P.O. Box 61542, Vancouver, Wash., 98666. I would be happy to assist you in any way possible. Mike and I have decided to give you a little hint before you begin the journey: "The key to success is a wide open experience." Good luck and happy Adventuring!

(Ken Ostrer, a senior and honor student at Vancouver, Washington's, Hudson Bay High School, enjoys computers, rock music, and science fiction. He hopes to someday enter the field of computer science.)

	1100... 1C37
70.....0426	1260....2000
140.... 076F	1360....2280
290.... 0A3E	1510... 24E2
390.... 0EE5	1610....2760
580.....1293	1720....2949
680.... 16B3	1830... 2C87
870.... 18F4	END... 2EC9

```
10 CLEAR120:CLS:LT=500:DIMA$(50)
,RM(50,4),IT$(35),IT(35),JT$(35)
:PRINT@230,"ENRAK":PRINT@262,"BY
 KEN OSTRER":PRINT@294,"MIKE SMI
TH":PRINT@326,"(C) MARCH 1983":P
RINT:DATANORTH,SOUTH,EAST,WEST
```

```
20 RT$(3)="THE DUKE OF 'BONE'
          BORN 786 - DIED 835":
RT$(4)="IQVQ QRGP EQHHKP CPF UOG
NN VJG  TQUG":RT$(5)="SILENCE IS
 NICE.."
30 DATA"NORTH OF A FOREST, THERE
 IS A  CAVE TO THE EAST"
40 DATAIN A CAVE,ON A WINDING MO
UNTAIN PASS,ON A FOREST TRAIL,AT
 A THREE-WAY INTERSECTION OF  PA
SSAGES,AT A TURN IN THE PASSAGE,
IN A LARGE CAVERN,IN A SMALL CAV
ERN,AT A BLOCKED PASSAGE,AT THE
BRINK OF A DEEP PIT,ON A FOREST
TRAIL
50 DATAIN A SMALL CLEARING,IN TH
E HEART OF A DARK FOREST,AT A RI
VER'S ESTUARY,IN A FOREST,ON A F
OREST PATH,ON A FOREST PATH,ON A
 JAGGED ROAD,ON A DARK ROAD,NORT
H OF A MINING TOWN,IN A MINING T
OWN
60 DATAAT A TOWN MARKETPLACE,IN
A PUB,AT A VERY QUIET GRAVEYARD,
AT AN ENTRANCE WAY
70 DATAIN A VERY LONG CORRIDOR,I
N THE MAIN LIBRARY,IN A VERY LON
G CORRIDOR,IN A GIANT LABORATORY
,IN A TORTURE ROOM,IN A TIME ROO
M.,IN A DINING ROOM,IN A SOUND P
ROOF ROOM,IN THE DUNGEON,IN AN A
NIMAL CAGE.
80 DATAIN A BEDROOM,IN THE MAIN
KITCHEN,IN A CIRCULAR ROOM,IN A
STOREROOM,IN A ROOM THAT RESEMBL
ES A       MORTUARY,AT A VERY LON
G AND NARROW FOYER,C
90 DATAOUTSIDE OF A STOREROOM,IN
 A TRIANGULAR-SHAPED ROOM.,B,AT
A LEDGE. THE MOON IS FULL    TON
IGHT,AT A VAMPIRE BAT CLUB HOUSE
,IN FRONT OF A GLOWING FIREPLACE
100 DATA"IN A MUSTY, DARK ROOM."
,IN LUTARN'S DEN. HINT+ LUTARN
 EXISTS IN A GASEOUS FORM.
110 DATA0,4,2,3,0,5,0,1,1,11,15,
0,1,13,0,0,2,10,6,0,0,7,0,5,6,9,
8,0,0,9,0,7,8,0,0,7,5,0,0,0,3,19
,12,0
120 DATA0,14,0,11,4,14,0,0,13,0,
16,12,0,0,0,3,0,17,0,14,16,0,0,1
8,0,0,17,20,11,20,0,0,19,21,18,0
,20,23,22,0,0,24,0,21
130 DATA21,0,24,0,22,0,0,23,26,0
,0,24,0,25,27,29,0,0,0,28,0,30,2
6,25,0,0,26,0,28,0,31,40,39,32,3
3,30,31,0,0,0,38,34,35,31
140 DATA33,0,0,0,37,36,0,33,35,0
,0,0,0,35,0,0,0,33,0,0,0,31,0,0,
0,41,30,42,40,46,48,0,0,43,40,0,
42,45,0,44,0,47,43,0
150 DATA43,0,46,0,41,0,0,45,44,5
0,0,0,0,49,0,41,48,0,0,0,47,0,0,
0
160 D$="NSEW":R=1:FORX=1TO4:READ
 D$(X):NEXTX:FORX=1TO50:READ A$(
X):NEXTX:FORX=1TO50:FORY=1TO4:RE
AD RM(X,Y):NEXTY,X:FORX=1TO35:RE
AD IT$(X),JT$(X),IT(X):NEXTX:PRI
NT"DO YOU WANT TO LOAD AN OLD GA
ME FROM TAPE?"
170 A$=INKEY$:IFA$="Y" THEN 1800
 ELSE IFA$<>"N" THEN 170
180 A$(45)="NEAR A CLOSED COFFIN
"
190 A$(42)="IN FRONT OF A LOCKED
 DOOR."
200 IFR>=26 AND AA=0 THEN CLSRND
(8):PRINT"A COLORFUL DARK MIST C
OVERS THE ROOM..":GOTO340
210 IFFG=-1 THEN IT$(29)="AN EMP
TY BEAKER"
220 CLS:PRINT"YOU ARE:":PRINTA$(
R)
230 PRINT:PRINT"OBVIOUS DIRECTIO
NS ARE:"
240 FORY=1TO4:IFRM(R,Y)<>0 THEN
PRINTD$(Y);"-> ";:NEXTY ELSE NEX
TY
250 PRINT:I=0:PRINT:PRINT"YOU SE
```


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E: ":IFR=2 THEN PRINT"OLD HERMIT
":I=1
260 IFR=21 AND ZZ<>-1 THEN PRINT
"GUNFIGHTER WITH THE MAGIC GLOVE
":I=1
270 FORX=1TO35
280 IFIT(X)=R THEN PRINTIT$(X):I
=1
290 NEXT
300 IF I=0 THEN PRINT"NOTHING"
310 IFYD=-1 THEN PRINT:PRINT"THE
 POISON OF LUTARN WAS FATAL.":GO
TO1730
320 IFZZ<>-1 AND R=21 THEN GOSUB
1860
330 X=RND(35):IFRND(40)=1 AND IT
(X)=-1 AND X<>19 THEN PLAY"T3402
CCCDDDEEEFFF":PRINT:PRINT"A GIAN
T VULTURE HAS CARRIED OFF YOUR..
??":IT(X)=RND(24):J=J-1
340 PRINT:LINEINPUT">";I$:IFAA=-
1 THEN LT=LT-1:IFLT=0 THEN PRINT
"YOUR LIGHT HAS RAN OUT..":GOTO1
730
350 IFLEFT$(I$,5)="MOVE " THEN 1
340 ELSEIFLEFT$(I$,4)="HELP" THE
N 1880 ELSE IFLEFT$(I$,4)="QUIT"
 THEN END ELSE IFLEFT$(I$,4)="SI
NG" THEN 1920 ELSE IFLEFT$(I$,6)
="SHOOT " THEN 1820 ELSE IFLEFT$
(I$,6)="CRACK " THEN 1750 ELSE I
FLEFT$(I$,5)="WEAR " THEN1620
360 IFLEFT$(I$,6)="TOUCH " THEN
1650 ELSE IFLEFT$(I$,4)="DIP " T
HEN 1480 ELSE IFLEFT$(I$,4)="ASK
 " THEN 1230 ELSE IFLEFT$(I$,4)=
"SAVE" THEN 1780 ELSE IFLEFT$(I$
,5)="CALL " THEN 1690 ELSE IFLEF
T$(I$,5)="GIVE " THEN 1310 ELSE
IFLEFT$(I$,5)="LOAD "THEN1940
370 IFLEFT$(I$,5)="SHOW " THEN 1
080 ELSE IFLEFT$(I$,5)="POUR " T
HEN 1580 ELSE IFLEFT$(I$,7)="UNL
OCK " THEN 1370 ELSE IFLEFT$(I$,
5)="OPEN " THEN 1180 ELSE IFLEFT
$(I$,6)="THROW " THEN 1270 ELSE
IFLEFT$(I$,3)="DIG" THEN 1110
380 IFLEFT$(I$,5)="FEED " THEN 1
520 ELSE IFLEFT$(I$,5)="SCORE" T
HEN 1060 ELSE IFLEFT$(I$,7)="INS
ERT " THEN 1550 ELSE IFLEFT$(I$,
6)="SMELL " THEN 1150 ELSE IFLEF
T$(I$,6)="LIGHT " THEN 950
390 IFLEFT$(I$,5)="DROP " THEN 7
50 ELSE IFLEFT$(I$,1)="L" THEN 2
00 ELSE IFLEFT$(I$,1)="I" THEN 6
50 ELSE IFLEFT$(I$,4)="GET " THE
N 480 ELSE IFLEFT$(I$,4)="SAY "
THEN 1020 ELSE IFLEFT$(I$,4)="BU
Y " THEN 910 ELSE IFLEFT$(I$,5)=
"READ " THEN 860
400 IFRM(25,3)=0 AND I$="N" AND
R=25 THEN PRINT"THE COUNT IS IN
YOUR WAY..":GOTO340
410 FORX=1TO4
420 IFMID$(D$,X,1)=I$ THEN 450
430 NEXTX
440 PRINT"W-H-A-T ? ? ?":GOTO340
450 IFRM(R,X)=0 THEN PRINT"YOU C
AN'T GO THAT WAY":GOTO340
460 R=RM(R,X)
470 GOTO200
480 G$=RIGHT$(I$,LEN(I$)-4):G$=L
EFT$(G$,3)
490 IFR=49 AND G$=LEFT$(JT$(25),
3) OR R=49 AND G$=LEFT$(JT$(26),
3) THEN PRINT"IT CANNOT BE TAKEN
 OFF OF THE   WALL..":GOTO340
500 IFG$=LEFT$(JT$(19),3) AND R=
22 AND BU<>1 THEN PRINT"THE LANT
ERN COSTS MONEY..":GOTO340
510 IFG$=LEFT$(JT$(31),3) AND R=
50 AND IT(31)=50 OR G$=LEFT$(JT$
(22),3) AND R=20 THEN PRINT"THAT
 IS NOT WITHIN YOUR POWER..":GOT
O340
520 IFUP<>-1 AND G$=LEFT$(JT$(8)
,3) AND R=10 THEN PRINT"A SEMI-F
ORCE FIELD IS GUARDING THE ROSE.
```


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```
."GOTO340
530 IFNF<>-1 AND G$=LEFT$(JT$(6)
,3) AND R=48 THEN PRINT"IT'S TOO
 HOT..":GOTO340
540 IFG$=LEFT$(JT$(34),3) AND R=
35 AND AG<>-1 THEN PRINT"THE GOR
ILLA WON'T LET YOU TAKE  IT..":G
OTO340
550 FORX=3TO34
560 IFX>8 AND X<19 AND IT(X)=33
AND R=33 AND G$=LEFT$(JT$(X),3)
THEN MS=MS-10
570 IFJ=6 THEN 850 ELSE IFLEFT$(
JT$(X),3)=G$ AND IT(X)=R THEN J=
J+1:IT(X)=-1:PRINT"OK":PLAY"T805
CFE":GOTO340
580 NEXT
590 PRINT"I DON'T FEEL LIKE IT..
":GOTO340
600 DATACOUNT DRACULA,DRACULA,25
,THE TOWN DRUNK,DRUNK,23,BROKEN
TOMBSTONE,TOMBSTONE,24,A FADED S
IGN,SIGN,8,STONE TABLET,TABLET,0
,GLOWING EMBER,EMBER,48,WOODEN S
HOVEL,SHOVEL,15,ROSE BUD,ROSE,10
610 DATA**MAGIC OYSTER**,OYSTER,
46,**SILVER COMPASS**,COMPASS,0,
**DISK OF THE GODS**,DISK,38,**T
URQUOISE CROSS**,CROSS,7,**ANTIQ
UE CLOCK**,CLOCK,0,**SOME GLOWIN
G RUBIES**,RUBIES,0,**PERUVIAN E
MERALDS**,EMERALDS,0,**SPARKLING
 PEARL**,PEARL,0
620 DATA**CROWN JEWELS OF BAVARI
A**,JEWELS,0,**SILVER BRACELET**
,BRACELET,0
630 DATALANTERN AND OIL,LANTERN,
22,GOLD NUGGETS,NUGGETS,0,DIAMON
D KEY,KEY,0,STRANGE LOOKING BOX,
BOX,20,HOLLOW STICK,STICK,24,WHI
SKEY BOTTLE,BOTTLE,0,EINSTEIN'S
PORTRAIT,PORTRAIT,49,NEWTON'S PI
CTURE,PICTURE,49,METAL STRAINER,
STRAINER,17
640 DATASOME ALGAE,ALGAE,14,BEAK
ER OF WATER,BEAKER,29,MAGIC GLOV
E,GLOVE,0,THE HIDEOUS LUTARN,LUT
ARN,0,LARGE EGG,EGG,0,REVOLVER,R
EVOLVER,0,A BULLET,BULLET,35,WAL
L SAFE,SAFE,0
650 PRINT"YOU ARE CARRYING:"
660 IFAA=-1 THEN LA$="LIT " ELSE
 LA$="UNLIT "
670 IFIT(19)=-1 THEN PRINTLA$;IT
$(19):I=1
680 I=0:FORX=3TO34
690 IFIT(19)=-1 THEN I=1
700 IFX=19 THEN X=20
710 IFIT(X)=-1 THEN PRINTIT$(X):
I=1
720 NEXT
730 IF I=0 THEN PRINT"NOTHING"
740 GOTO340
750 G$=RIGHT$(I$,LEN(I$)-5):G$=L
EFT$(G$,3)
760 IFG$=LEFT$(JT$(19),3) AND IT
(18)=-1 THEN AA=0
770 IFG$=LEFT$(JT$(30),3) AND IT
(30)=-1 THEN PRINT"IT IS A PART
OF YOU NOW..":GOTO340
780 FORX=3TO34
790 IFX>8 AND X<19 AND IT(X)=-1
AND R=33 AND G$=LEFT$(JT$(X),3)
THEN MS=MS+10
800 IFIT(X)=-1 AND LEFT$(JT$(X),
3)=G$ THEN 830
810 NEXT
820 GOTO590
830 J=J-1:PRINT"OK":IT(X)=R
840 IFMS=100 THEN PRINT"YOU SOLV
ED THE ADVENTURE...":PLAY"ABCDEF
G04T5GFEDCBA":GOTO1780 ELSE 340
850 PRINT"YOU CAN'T CARRY ANYTHI
NG ELSE..":GOTO340
860 G$=RIGHT$(I$,LEN(I$)-5):G$=L
EFT$(G$,3)
870 FORX=3TO5
880 IFIT(X)=-1 AND G$=LEFT$(JT$(
X),3) THEN PRINTCHR$(34);RT$(X);
```


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```
CHR$(34):GOTO340
890 NEXTX
900 GOTO590
910 G$=RIGHT$(I$,LEN(I$)-4):G$=L
EFT$(G$,3)
920 IFR=22 AND BU=1 THEN PRINT"W
E'RE ALL OUT BUDDY..":GOTO340
930 IFG$=LEFT$(JT$(19),3) AND R=
22 AND IT(20)=-1 AND J<>6 THEN B
U=1:GOTO550
940 GOTO590
950 G$=RIGHT$(I$,LEN(I$)-6):G$=L
EFT$(G$,3)
960 IFIT(19)=-1 AND G$="ON" THEN
 980 ELSE IFIT(19)=-1 AND G$="OF
F" THEN 1000
970 GOTO590
980 IFAA=-1 THEN PRINT"IT'S ALRE
ADY ON..":GOTO340
990 AA=-1:GOTO200
1000 IFAA=0 THEN PRINT"IT'S ALRE
ADY OFF..":GOTO340
1010 AA=0:GOTO200
1020 G$=RIGHT$(I$,LEN(I$)-4)
1030 IFRM(24,4)=0 THEN 1050
1040 IFR=24 AND G$="BONE" THEN R
M(24,4)=0:RM(24,3)=25:GOTO220
1050 PRINT"OK":PRINTCHR$(34);G$;
CHR$(34):GOTO340
1060 PRINT"OUT OF 100 POINTS YOU
 HAVE       SCORED";MS;"POINTS."
1070 PRINT"LIGHT LEFT=";LT:GOTO3
40
1080 G$=RIGHT$(I$,LEN(I$)-5):G$=
LEFT$(G$,3)
1090 IFRM(25,3)=0 AND G$=LEFT$(J
T$(12),3) AND IT(12)=-1 AND R=25
 THEN PRINT"THE COUNT FLIES AWAY
 IN PAIN..":IT(1)=0:RM(25,3)=28:
GOTO340
1100 GOTO590
1110 IFIT(7)<>-1 THEN PRINT"NO S
HOVEL":GOTO340
1120 IFR=10 AND IT(31)=-2 AND IT
(32)=0 THEN IT(32)=10:GOTO220
1130 IFR=12 AND IT(21)=0 THEN IT
(21)=12:GOTO220
1140 PRINT"NOTHING HERE FRIEND..
":GOTO340
1150 G$=RIGHT$(I$,LEN(I$)-6):G$=
LEFT$(G$,3)
1160 IFIT(5)=0 AND G$=LEFT$(JT$(
8),3) AND R=45 AND OP=-1 AND IT(
8)=-1 THEN IT(5)=45:IT(10)=16:GO
TO200
1170 IFG$=LEFT$(JT$(8),3) AND IT
(8)=-1 THEN PRINT"AHHH!! WHAT BE
AUTY..":GOTO340 ELSE PRINT"MY NO
SE IS STUFFED UP..":GOTO340
1180 G$=RIGHT$(I$,LEN(I$)-5):G$=
LEFT$(G$,3)
1190 IFIT(13)=0 AND G$=LEFT$(JT$
(22),3) AND IT(23)=0 AND R=20 TH
EN IT(24)=20:IT(13)=31:IT(33)=20
:GOTO200
1200 IFIT(23)<>0 AND G$=LEFT$(JT
$(22),3) AND R=20 THEN PRINT"AN
ANGRY DOG IS GUARDING THE    STR
ANGE BOX..":GOTO340
1210 IFOP<>-1 AND G$=LEFT$("COFF
IN",3) AND R=45 AND IT(21)=-1 TH
EN OP=-1:A$(45)="NEAR AN OPEN CO
FFIN":GOTO200
1220 GOTO590
1230 G$=RIGHT$(I$,LEN(I$)-4):G$=
LEFT$(G$,3)
1240 IFDS=-1 AND G$=LEFT$(JT$(2)
,3) AND R=23 THEN PRINTCHR$(34);
"ADD ONE LETTER TO EACH LETTER
 IN THE PHRASE..";CHR$(34):GOTO3
40
1250 IFG$=LEFT$(JT$(2),3) AND R=
23 THEN PRINTCHR$(34);"FOR A BOT
TLE OF WHISKEY I COULD BECOME VE
RY TALKATIVE..";CHR$(34):GOTO340
1260 GOTO590
1270 G$=RIGHT$(I$,LEN(I$)-6):G$=
LEFT$(G$,3)
1280 IFIT(31)=50 AND R=50 AND IT
```


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```
(6)=-1 AND G$=LEFT$(JT$(6),3) AN
D IT(31)=50 THEN PRINT:PRINT"LUT
ARN BURNS FIERCELY. A VOICE  SAY
S";CHR$(34);"GID TA TIP";CHR$(34
):FORI=1TO1500:NEXTI:IT(6)=50:IT
(31)=-2:J=J-1:GOTO220
1290 IFIT(23)=-1 AND G$=LEFT$(JT
$(23),3) AND R=20 THEN PRINT"THE
 DOG RUNS FOOLISHLY AFTER    THE
 STICK..":IT(23)=0:J=J-1:GOTO300
1300 GOTO760
1310 G$=RIGHT$(I$,LEN(I$)-5):G$=
LEFT$(G$,3)
1320 IFDS<>-1 AND R=23 AND G$=LE
FT$(JT$(24),3) AND IT(24)=-1 THE
N PRINT"THE DRUNK TAKES THE BOTT
LE        IMMEDIATELY..":DS=-1:IT(
24)=0:IT$(2)="THE HAPPY TOWN DRU
NK":J=J-1:GOTO340
1330 GOTO760
1340 G$=RIGHT$(I$,LEN(I$)-5):G$=
LEFT$(G$,3)
1350 IFIT(35)=0 AND G$=LEFT$(JT$
(25),3) AND R=49 THEN IT(35)=49:
GOTO200
1360 GOTO590
1370 G$=RIGHT$(I$,LEN(I$)-7):G$=
LEFT$(G$,3)
1380 IFIT(15)=0 AND G$=LEFT$(JT$
(35),3) AND IT(35)=49 AND R=49 T
HEN 1400
1390 GOTO590
1400 PRINTCHR$(34);"REFER TO BIR
TH DIGITS";CHR$(34);" SAYS AN EC
HOING VOICE.."
1410 FORI=1TO1000:NEXTI:CLS:FORX
=1TO3
1420 B$(1)="LEFT":B$(2)="RIGHT":
B$(3)="LEFT"
1430 PRINT@70,B$(X);" VALUE":INP
UTC(X)
1440 IFC(X)<=0 THEN 1430
1450 NEXTX
1460 IFC(1)=7 AND C(2)=8 AND C(3
)=6 THEN PRINT"THE SAFE CREAKS O
PEN..":FORH=1TO750:NEXT:IT(14)=4
9:IT(15)=49:GOTO200
1470 PRINT"THE SAFE DIDN'T OPEN.
.":FORH=1TO750:NEXTH:GOTO200
1480 G$=RIGHT$(I$,LEN(I$)-4):G$=
LEFT$(G$,3)
1490 IFIT(20)<>0 AND R=14 AND G$
=LEFT$(JT$(27),3) AND IT(27)=-1
THEN GOTO1140
1500 IFG$=LEFT$(JT$(27),3) AND R
=14 AND IT(27)=-1 THEN IT(20)=14
:GOTO200
1510 GOTO590
1520 G$=RIGHT$(I$,LEN(I$)-5):G$=
LEFT$(G$,3)
1530 IFIT(16)=0 AND G$=LEFT$(JT$
(9),3) AND IT(9)=-1 AND IT(28)=-
1 THEN PRINT"THE OYSTER EATS THE
 ALGAE.":PRINT"AND SOMETHING IN
IT DISAPPEARS":FORI=1TO750:NEXTI
:IT(16)=2:IT(28)=0:J=J-1:GOTO200
1540 GOTO590
1550 G$=RIGHT$(I$,LEN(I$)-7):G$=
LEFT$(G$,3)
1560 IFIT(17)=0 AND G$=LEFT$(JT$
(16),3) AND R=42 AND IT(16)=-1 T
HEN A$(42)="IN FRONT OF AN UNLOC
KED DOOR.":IT(17)=42:GOTO200
1570 GOTO590
1580 G$=RIGHT$(I$,LEN(I$)-5):G$=
LEFT$(G$,3)
1590 IFFG<>-1 AND R<>10 AND G$=L
EFT$("WATER",3) AND IT(29)=-1 TH
EN PRINT"YOU'RE ARE IN TROUBLE N
OW..":FORI=1TO500:NEXTI:FG=-1:GO
TO200
1600 IFFG<>-1 AND UP<>-1 AND IT(
29)=-1 AND G$=LEFT$("WATER",3) A
ND R=10 THEN UP=-1:FG=-1:PRINT"T
HE FORCE FIELD IS DESTROYED":FOR
I=1TO500:NEXTI:GOTO200
1610 GOTO590
1620 G$=RIGHT$(I$,LEN(I$)-5):G$=
LEFT$(G$,3)
```


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```
1630 IFNF<>-1 AND G$=LEFT$(JT$(3
0),3) AND IT(30)=-1 THEN PRINT"N
ICE FIT..":NF=-1:GOTO340
1640 GOTO590
1650 G$=RIGHT$(I$,LEN(I$)-6):G$=
LEFT$(G$,3)
1660 IFG$=LEFT$("HERMIT",3) AND
R=2 AND NF=-1 THEN PRINT"YOU FEE
L DIZZY FOR A MOMENT":PH=-1:GOTO
340
1670 IFG$=LEFT$("HERMIT",3) AND
R=2 AND NF<>-1 THEN PRINT"YOU HA
VE JUST DIED..":GOTO1730
1680 GOTO590
1690 G$=RIGHT$(I$,LEN(I$)-5):G$=
LEFT$(G$,3)
1700 IFIT(31)<>-2 AND G$=LEFT$(J
T$(31),3) AND R=50 AND PH=-1 THE
N IT(31)=50:GOTO220
1710 IFG$=LEFT$(JT$(31),3) AND R
=50 AND PH<>-1 THEN YD=-1:IT(31)
=50:GOTO220
1720 GOTO590
1730 CLEAR:PRINT"DO YOU WANT TO
PLAY AGAIN?"
1740 A$=INKEY$:IFA$="Y" THEN GOT
O10 ELSE IFA$="N" THEN END ELSE
1740
1750 G$=RIGHT$(I$,LEN(I$)-6):G$=
LEFT$(G$,3)
1760 IFIT(18)=0 AND G$=LEFT$(JT$
(32),3) AND IT(32)=-1 THEN IT(18
)=5:PRINT"SOMETHING FALLS OUT.."
:PRINT"THEN DISAPPEARS":FORI=1TO
500:NEXTI:GOTO220
1770 GOTO590
1780 INPUT"FILENAME";FI$:IFFI$="
" THEN 1780
1790 OPEN"O",-1,FI$:FORX=1TO35:P
RINT#-1,IT(X):NEXTX:PRINT#-1,IT$
(2),J,R,MS,DS,OP,RM(24,3),RM(24,
4),RM(25,3),A$(45),A$(42),LT,AA,
FG,UP,NF,BU,PH,ZZ,AG,LO,IT$(33):
CLOSE:PRINT"OK":IFMS=100 THEN 17
30 ELSE 340
1800 INPUT"FILENAME";FI$:IFFI$="
" THEN 1800
1810 OPEN"I",-1,FI$:FORX=1TO35:I
NPUT#-1,IT(X):NEXTX:INPUT#-1,IT$
(2),J,R,MS,DS,OP,RM(24,3),RM(24,
4),RM(25,3),A$(45),A$(42),LT,AA,
FG,UP,NF,BU,PH,ZZ,AG,LO,IT$(33):
CLOSE:GOTO200
1820 G$=RIGHT$(I$,LEN(I$)-6):G$=
LEFT$(G$,3)
1830 IFIT(33)=-1 AND LO=-1 AND Z
Z<>-1 AND G$=LEFT$("GUNFIGHTER",
3) AND R=21 THEN PRINT"YOU KILLE
D THE GUNFIGHTER..":IT(30)=21:FO
RI=1TO1000:NEXTI:ZZ=-1:IT$(33)="
EMPTY REVOLVER":GOTO200
1840 GOTO590
1850 END
1860 IFRND(10)=1 THEN PRINT:PRIN
T"THE GUNFIGHTER FILLED YOU FULL
  OF LEAD..":GOTO1730
1870 GOTO340
1880 IFR=50 THEN PRINT"WITHOUT T
HE TOUCH, THE SIGHT OF LUTARN WI
LL KILL YOU..":GOTO340
1890 IFR=2 THEN PRINT"TOUCH THE
HERMIT ONLY WHILE THE GLOVE IS O
N..":GOTO340
1900 IFR=20 THEN PRINT"LUTARN LO
VES TO HEAR HIS NAME..":GOTO340
1910 PRINT"NOT NOW..":GOTO340
1920 IFAG<>-1 AND R=35 THEN PRIN
T"THE GORILLA FALLS ASLEEP..":AG
=-1:GOTO340
1930 PRINT"YOU'RE A LITTLE OFF T
UNE..":GOTO340
1940 G$=RIGHT$(I$,LEN(I$)-5):G$=
LEFT$(G$,3)
1950 IFLO<>-1 AND G$=LEFT$(JT$(3
3),3) AND IT(33)=-1 AND IT(34)=-
1 THEN PRINT"OK":LO=-1:IT$(33)="
LOADED REVOLVER":IT(34)=0:J=J-1:
GOTO340
1960 GOTO590
```


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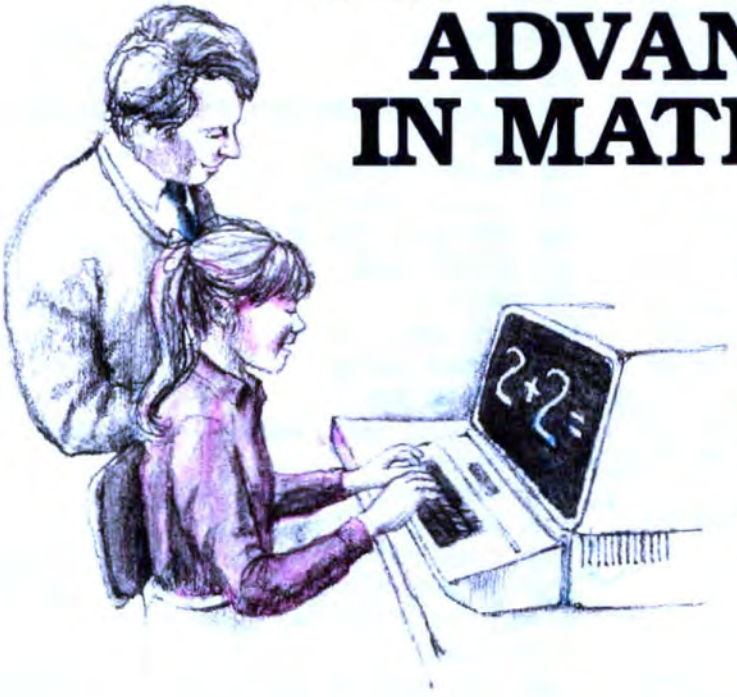
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The program first reads the eight chords. Then each "song" or "tune" is read. The components of the song are picked using the





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*MID$* function. Each segment is checked to see if it is a "O," or Octave Marker (line 190), "K," or Chord Market (line 210), "L," or Length Marker (line 230), or if the note is flat "-" or sharp "+" (line 150. If the string begins with a letter between "A" and "G," it is assumed to be a note, and the previously defined elements are combined with the number of repetitions defined by 24/ (value after the L). This note/chord combination is played for immediate verification. The created string is added to a string array that will compose the final musical product (PP$(Z)=P$). If the length of the element of the array exceeded 250 characters, the next element of the array is selected (Z=Z+1). Lines 300-360 plays the created song (chords and notes) at three different Tempos. The Tempos selected were found by experimentation to represent the range of effects possible.

Line 250 was added to create a visual effect while the tunes were being played. Any reference to PP$ (in lines 250, 270, and 340) may be deleted without affecting the musical content. In fact, you will find that the tune will play somewhat more smoothly without printing graphics.

Because notes and chords are repeated frequently, creating all the strings needed for a given tune is quite memory consuming. An alternative is to simply generate and play the repetitions required for each note. However, unless you use machine language, the generation of chord notes may create too great a pause between notes for the desired effect.

There are some limitations you must follow in creating a turn. They include:

1) The value following L must equal 24 or less.
2) The tune cannot use dotted notes.
3) Letters other than A through G, L, K, and O are not recognized.



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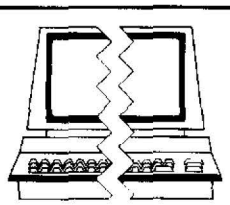
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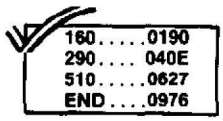
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The strings generated by the program (P$(Z)) can be saved and used in other programs.

(Dr. Santee has published poetry and curriculum as well as statistical and educational software (including CCM#3 for JARB Software). He is a recipient of several grants and awards for educational technology.)



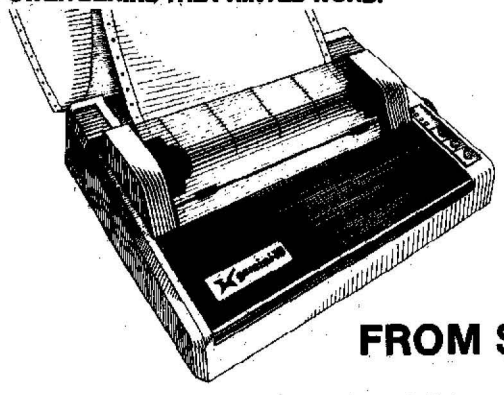
The listing:

```
10 CLS
20 CLEAR 7000:DIM P$(40),K$(8),P
P$(40)
30 PLAY "T250"
40 'read chords
50 FOR K=1 TO 8
60 READ K$(K)
70 NEXT K
80 FOR S=1 TO 5
90 'read song
100 READ S$
110 'pick out length/chords/octa
ves/notes
120 FOR A=1 TO LEN(S$)
130 M$=MID$(S$,A,1)
140 'check for sharps and flats
150 IF MID$(S$,A+1,1)="+" OR MID
$(S$,A+1,1)="-" THEN M$=MID$(S$,
A,2):A=A+1
160 'if M$= a note then combine
octives/notes/and chords for L r
epitions
170 IF LEFT$(M$,1)=>"A" AND LEFT
$(M$,1)=<"G" THEN P$="":FOR B=1
TO L:P$=P$+O$+M$+K$:NEXT B:PRINT
PP$;:PLAY P$:P$=P$+"P8":IF LEN(P
$)+LEN(P$(Z))>250 THEN Z=Z+1:P$(
Z)=P$(Z)+P$ ELSE P$(Z)=P$(Z)+P$
180 'check for octave marker "O"
190 IF M$="O" THEN O$=MID$(S$,A,
2):A=A+1
200 'check for chord markey "K"
210 IF M$="K" THEN A=A+1:K$=K$(V
AL(MID$(S$,A,1)))
220 'check for length marker "L"
230 IF M$="L" THEN IF VAL(MID$(S
$,A+1,2))>9 THEN L=INT(24/VAL(MI
D$(S$,A+1,2))):A=A+2 ELSE L=INT(
24/VAL(MID$(S$,A+1,1))):A=A+1
240 'creat something to watch on
 screen while music is playing
250 PP$=CHR$(ASC(M$)+90+RND(5)*1
6)+PP$:PP$(Z)=PP$
260 NEXT A
270 PP$=""
280 IF RIGHT$(S$,1)="*" THEN 100
290 'play tune with  3 different
 tempos
300 FOR T=1 TO 3
```

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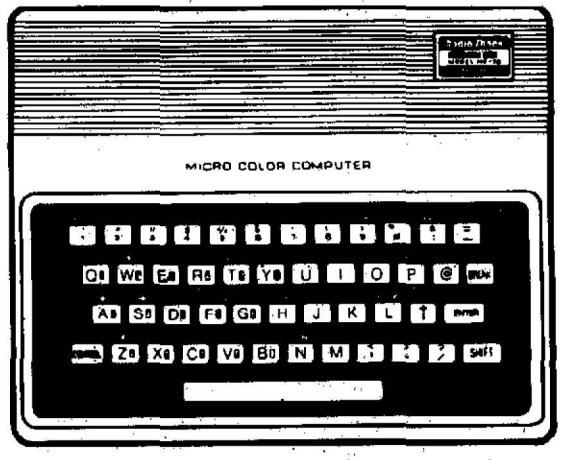
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```
310 PLAY"T4L4P1"
320 IF T=1 THEN T$="T25" ELSE IF
 T=2 THEN T$="T50" ELSE T$="T200
"
330 PLAY T$
340 FOR A=0 TO Z:PRINTPP$(A);:PL
AY P$(A):IF T=3 THEN P$(A)=""
350 NEXT A
360 NEXT T
370 Z=0
380 NEXT S
390 'chords
400 DATA"03804CE"
410 DATA"038B04G"
420 DATA"038B04F"
430 DATA"03A04CF+"
440 DATA"03A04CF"
450 DATA"03A04CE"
460 DATA"03A04DF"
470 DATA"038+B04E"
480 '********song*********
490 'Shortnin
500 DATA"05L8K10EK2L4DK1L80EK2L4
DK1L80EK2DE04BK4AK20805K10EK2D04
BK1050EK2L4DK1L80EK2DE04BK4AK2L4
804L8804EDE04805EDE04K2805EDE04B
K4AK2L48L8805EDE04805EDE04805EDE
B05DK2L40"
510 'We Three Kings
520 DATA"05K6L4AEL3AL8B05C04B05C
04A05L3EL8CL4DEK7L8FEDC04L4BK805
L4EK6L8DC04L8B05C04L4AEL3AL8B05C
04B05C04A05L3EL8CL4DEK7L8FEDCK6L
4C04K8BK6L3AK8L8BL4B805K6C04L8BA
L4BK6CK2L3DL8CL4DK8EK604AL8B05CK
7DC04BAK6A0+EBL4B805CK804L8BAL4B
K605CK2L3DL8CL4DK6EK7L8FEDC*"
530 DATA"K8L4C04BK6A04L3A"
540 'Bicycle Built for Two
550 DATA"05L3K10EC04GL8AB05C04L4
A05C04K1L380G05D8K1EK6CK404L8AB05
CL4DL8EK2L3D04L4D05L8EK3FEDL40L8
EK1DL4CCK2L8DK1L4EL8C04K5L4A05L8
CK104AL40K305F04L80K105L4CL8EK3D
L40K1CL8EK3DEFK10ECK3L4D05L8804K
1L3C05C"
560 'Camptown
570 DATA"05K2L8DD04B05DED04L4BK4
L8BL3AL8BL3AK205L8DD04B05DK2ED04
L4BK4L4AL8BAK2L38L80B05DL40G40K1
05L4EL80EK2L4D04B05L8DD04B05DED0
4L4BK4AL8BAK2L4G05G"
580 'America
590 DATA"K103L4CK6CK7DK2L302B03K
1L8CK2L4DK1EEK3FK1L3EK8L8DK6L4CK
7DK1C02K3B03K1L1CL4G80L38K3L8FK1
L4EK3FFFL3FK1L8EK2L4DK1EL8K5FK1E
K3DK1CL3EL8K3FK1L40K5L8AFK1L4EK3
DK1L3C04C05C"
```



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Time & Money: A Useful Financial Planning Tool

Planning your finances can be a very perplexing task. Things like an Individual Retirement Account, a mortgage, a certificate of deposit, and others, all have various different factors that must be taken into consideration. Sure, you could whip out your calculator and punch in the numbers, but why bother? CoCo can take on these problems with ease.

Time & Money is a program that will help you to evaluate the time value of your money. It will aid you in planning investments, loans, savings plans, and the like that involve compound interest. It is written in Extended BASIC, has machine language assists and requires 16K of memory.

When the program is run, you are presented with a choice of four types of calculations that can be performed, or a brief review of the operating instructions. The types of calculations that can be performed are as follows: *compound interest,* which involves a single deposit in an interest bearing account; *sinking fund,* which involves regular deposits into a savings plan; *loans,* which involves installment payments; and finally, a *lease* (or *annunity*), which involves payments (or withdrawals) until a specified ending balance is reached.

Each calculation selected, in turn, presents a "worksheet" screen, which allows for the entry of the appropriate figures. After you enter all of the "known" figures, the program will then calculate the "unknown" figure for you. Maybe I should explain this a little further. Let's say that you were to deposit $1,000 in a savings account that pays eight percent interest, compounded quarterly, and you want to leave the money in for 10 years. You would enter all of these "known" figures, and the program would then calculate the amount of money (the "unknown" figure) that would be in the account after the 10 years. Suppose now, that you wanted to have more money in the account, after the 10 years, than what was calculated. You could enter this amount, and make the interest rate or the initial deposit the "unknown" figure, and have the program calculate the interest rate or initial deposit required to achieve your goal.

Time & Money has several additional features that make using it very easy. Data can be entered as a simple mathematical expression. For example, the number of payments on a 25-year mortgage, can be entered as 12*25, instead of 300. In addition to calculating the "unknown" figures, it provides other information such as total payments, interest

Time & Money is an excellent financial planning tool. Since the program is in BASIC, I expected it to get bogged down at times, but it is remarkably swift. The documentation simply explains how to use the program, and includes several well thought out examples for you to follow. This made it very easy to get the most out of *Time & Money*, without having to spend a great deal of time studying the instructions. If you have ever spent hours slaving over a hot calculator, this program is for you. If it only had a print feature!

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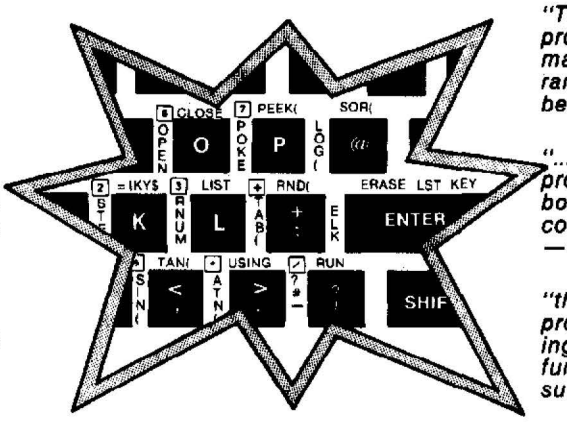
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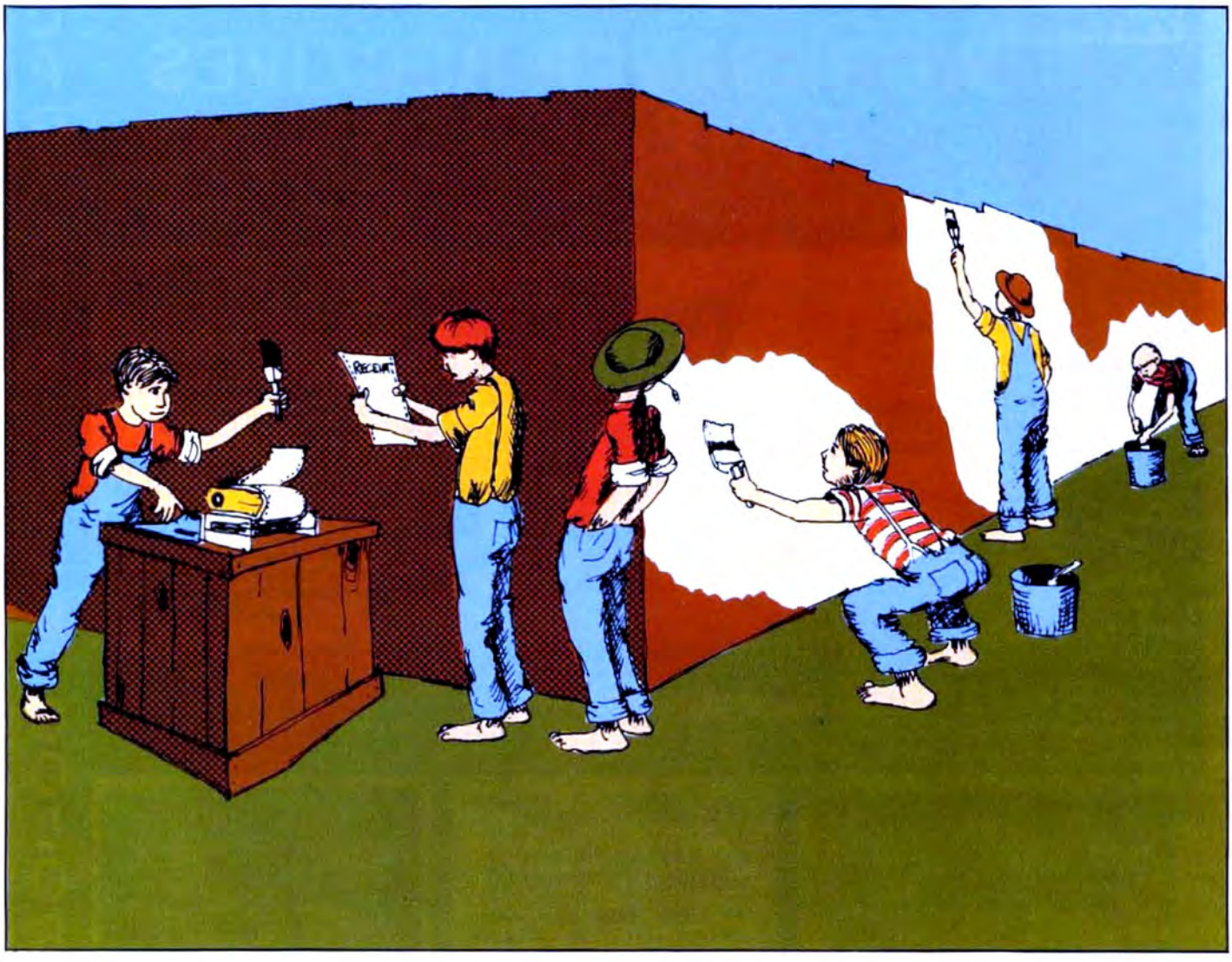
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By Dennis H. Weide

(Dennis Weide is employed with AT&T and works in the 4ESS (#4 Electronic Switching System). He is an amateur computerist and teaches BASIC *programming in the evenings to promote his hobby.)*

One of my hobbies is making toys. Several years ago, my wife and I turned this hobby into a profitable part time business. When I bought my Color Computer, I decided to write some simple programs to help manage the business. *Sales Register* is a program that runs on a 16K Color Computer with Extended Color BASIC. Whether you sell toys, cosmetics, household products or some special service, you can modify this program to fit your needs.

What Does It Do?

Sales Register acts as an onsight cash register and sales recorder. It also does some minor inventory control.

When we sell our products at crafts fairs, we use the program as a cash register. It produces a customer sales receipt on the printer and a business record on the cassette. At the end of the day, I rewind the cassette and go home. Once home, I load and run the program and select the retrieve function. While I eat my dinner, the computer is compiling all the data for me and listing the totals. I then enter them in my ledger and save the cassette in a safe place.

During the Christmas season, we receive a lot of telephone orders. I usually keep the program loaded and running during the day while I am at work. When a customer calls and places an order, my wife enters it in the computer. When it comes time to make the toys, we run an inventory sales list. One look at the list tells us how many of each toy we must make. When delivery date rolls

TURN YOUR COMPUTER INTO A CASH REGISTER

around, I can either use the customers copy or retrieve another copy to have a record of the customer's name, address and order.

How The Program Works

A short explanation of the program will help you to understand it. Before you *CLOAD* the program, enter this statement first to clear all graphics memory: POKE 25,6:NEW.

When you run the program, a menu appears. You have three choices:

1) Compile sales data
2) Retrieve sales data
3) Read inventory data

Compile Sales Data

To compile sales data, enter a "1" when the menu appears. Each time you enter the compile mode, you will be asked to enter the date. You will also be asked if you want a printer copy or a magnetic tape copy. The printer copy can be used as a customer receipt or for your own records. The magnetic tape copy is a permanent record for you that can be used to analyze the data. If you choose a printer copy, be sure to turn the printer on. If you select a magnetic tape copy, be sure to load a blank cassette into your recorder and set it to record.

After you have answered these prompts, a sales form will appear on the screen. The cursor will be located next to "SOLD TO." Type the customer's name and *ENTER*. Then type the customer's address and *ENTER*. The cursor will move under the "ITEM" column. Type the name of the item sold as it is listed in the inventory data (we will see how to enter inventory data later) and *ENTER*. The cursor then moves under the "QUAN" column. Type the quantity of this item that the customer is purchasing and *ENTER*. The cursor will move to the "PRICE EA." Type in the price of one item. When you press *ENTER* the program will multiply the price of one item by the quantity purchased and print the total under the "PRICE EA." column. Press *ENTER* one more time. The cursor will disappear. If your entries are incorrect, press E. This will erase the last line entered and set the program up for another entry. If you should discover that you have made an error after you have pressed *ENTER*, keep pressing *ENTER* until the cursor disappears. Then press E to erase the entire line from the program. If your entry is correct, and you wish to make another, press *ENTER*. The cursor will move down one line and wait for the next entry. Press *CLEAR* if you are finished. When *CLEAR* is pressed, the program will compute and display the subtotal, sales tax and the total. Also, if you have chosen a magnetic tape copy or a printer copy, the program will generate those for you (see Figure 1 for a customer receipt sample).

Figure 1

Figure 1
Sample of Customer Receipt

```
D&M WOOD PRODUCTS

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4 JUNE 1983

SEDAN 1930          ( 2 )     $  32.00
FORD VAN            ( 1 )     $   7.00
LRG HELICOPTER      ( 1 )     $  12.50
                      ---     --------
SUBTOTAL              4       $  51.50
SALES TAX                     $   2.06
                              --------
TOTAL                         $  53.56

WE GUARANTEE YOUR SATISFACTION
```

After all this is finished, a prompt will tell you to press *ENTER* to continue. When you do, the screen will clear and a new sales form will appear with the cursor positioned next to "SOLD TO." You are now ready to make another sale.

Some Handy Options

If you type "MENU" next to "SOLD TO," the program will return to the main menu and allow you to pick another program function. If you type "TOTAL" next to "SOLD TO," the program will display the total amount of sales and taxes for this run of the program. In addition, if you have retrieved any data from cassette before the run, the totals for that data will be added to the current total.

For the first entry of the day, enter "START" next to "SOLD TO." For the last entry of the day, enter "END" next to "SOLD TO." These two keywords are used by the program to locate the start and end of the daily sales. They are also good points of reference when you retrieve the data for analysis.

The program will accept returns and refunds. Just enter "RETURN" or "REFUND" (for your own information) next to "SOLD TO" and enter the quantity as a negative number. The program will compute everything for you.

Retrieving Data

To retrieve data, rewind the cassette and press "PLAY." Then type "2" when the menu appears. The program will ask if you want a printer copy or an inventory list. The printer copy (see Figure 2) shows the date, customer's name and address, and the items sold. It also shows the total of that sale as well as the daily total up to and including that sale. This is done in case of multilated data on the cassette. If one sales record is lost, the total will still be displayed on the next good record.

A crosshatch (#) printed next to the item sold indicates that this item did not match anything in the inventory.

The inventory list (see Figure 3) will print each item of the inventory, the price of that item, the quantity sold and the total earned from each item. At the end, it will total all the sales for both the matched and mismatched data. You will have to adjust the inventory manually for the mismatched data. This is done for all entries between "START" and "END." Analyzing this data can show which items are the profit makers.

Reading Inventory Data

To read inventory data, enter "3" when the menu is displayed. Again, you have the option of a printer copy. This copy (Figure 4) simply shows you the entire inventory list for reference and editing. It can also be used as a price list. The program will read all data statements and list a line number, the item and its price. This is useful for adding or deleting items in the inventory data statements. After all inventory items have been read, the program returns to the main menu.

Figure 2
Sample of Retrieved Data

```
**********************************************
1 MARCH 1983
START OF DATA


**********************************************
1 MARCH 1983
SOLD TO   JOHN DOE
ADDRESS   1500 E. ANYPLACE ST.

  ITEM SOLD          QUANTITY        PRICE EA.        TOTAL PRICE
-------------------------------------------------------------------
SEDAN 1930              2            $  8.00          $  16.00
FORD VAN                1            $  7.00          $   7.00
LRG HELICOPTER  #       1            $ 12.50          $  12.50
                                                      ---------
DAILY SUBTOTAL       $ 35.50         SUBTOTAL         $  35.50
DAILY TAX            $  1.42         TAX              $   1.42
                     --------                         ---------
DAILY TOTAL          $ 36.92         TOTAL            $  36.92


**********************************************
1 MARCH 1983
SOLD TO   MARY SMITH
ADDRESS   8501 W.SOMEPLACE AVE.

  ITEM SOLD          QUANTITY        PRICE EA.        TOTAL PRICE
-------------------------------------------------------------------
T-28 PLANE              1            $  8.00          $   8.00
                                                      ---------
DAILY SUBTOTAL       $ 43.50         SUBTOTAL         $   8.00
DAILY TAX            $  1.74         TAX              $   0.32
                     --------                         ---------
DAILY TOTAL          $ 45.24         TOTAL            $   8.32


**********************************************
1 MARCH 1983
END OF DATA
```

The last line of the program should be 24800 DATA END,0. Line 3800 reads this line to determine when it reaches the end of the inventory. When you use this program, delete lines 24400 through 24700 and add your own inventory at this point. You can increment your line numbers as you wish (i.e., 24400, 24401, etc.)

I have limited all item names to 15 characters in length so that they can be displayed easily on the screen. You can use longer names if you do not care about the screen display but it will require more memory. Also, the program matches the item you type in to the inventory list so keeping it short makes the job easier all the way around.

Entering Your Own Inventory

Entering your own inventory is simple. Use data statements to list the item and price. In my program listing, the first data statement is at line 24400. The first item is a toy Cessna 172 airplane which sells for $18.50. The second item is a toy Stearman airplane which sells for $22.50. As you can see, the inventory is entered as ITEM,PRICE EACH, ITEM,PRICE EACH,etc. The data statements can be up to 255 characters per statement but I find it easier to keep them relatively short. You can add as large an inventory as memory will permit. This program listing runs in 16K with a little room left over.

Control Codes

This program was written for a Line Printer VII. However, I have used control codes for the printer functions so that if you have a different printer, you can change the codes and the program will run on your printer. Here are the codes:

P1$ prints 32 "#" on the screen

P2$ prints 32 blank spaces on the screen
P3$ sends a line feed to the printer
P4$ sets LINE PRINTER VII to large font
P5$ sets LPVII to small font (normal)
P6$ prints 80 dashes across paper
P7$ prints 40 cross hatches across paper (large font)

Changing Variables

Line 2400 sets the name of your business. Replace the letters inside the quotation marks with the name of your business.

Line 2800 sets the state gross receipts tax (sales tax). If your state sales tax is 4.5 percent then line 2800 should look like this: 2800 TX=.045

Line 3200 sets the business telephone number and line 3300 sets the final message that you want printed on the customer's receipt. Again, just change the letters inside the quotes to indicate your business phone number or any message you might wish to appear on your sales receipt.

Some Final Notes

When compiling sales data, the program allows ten line entries per customer. If you want to increase the number of line entries, you must dimension IS$,

Figure 3
Sample of Inventory List

INVENTORY SALES LIST

INVENTORY ITEM	PRICE EA.	QUANTITY SOLD	TOTAL PRICE
CESSNA 172	$ 18.50	0	$ 0.00
STEARMAN	$ 22.50	0	$ 0.00
F-86 SABRE	$ 5.00	0	$ 0.00
C-130 HERCULES	$ 14.00	0	$ 0.00
T-28 PLANE	$ 8.00	1	$ 8.00
BIPLANE W/PROP	$ 14.00	0	$ 0.00
DC-8 JET	$ 14.00	0	$ 0.00
LRGE BIPLANE	$ 30.00	0	$ 0.00
LRGE C-130	$ 25.00	0	$ 0.00
SE5A BIPLANE	$ 16.00	0	$ 0.00
LRGE HELICOPTER	$ 12.50	0	$ 0.00
SM HELICOPTER	$ 10.00	0	$ 0.00
FORD VAN	$ 7.00	1	$ 7.00
TRUCK STKBD	$ 10.00	0	$ 0.00
SPCAR MGA	$ 8.00	0	$ 0.00
SEDAN 1930	$ 8.00	2	$ 16.00
COUPE 1930	$ 8.00	0	$ 0.00
SEDAN 1940	$ 8.00	0	$ 0.00
BLAZER	$ 7.00	0	$ 0.00
JEEP	$ 7.00	0	$ 0.00
TR-7 CAR	$ 7.00	0	$ 0.00
BLAZER W/BOAT	$ 14.00	0	$ 0.00
JEEP W/CAMPER	$ 14.00	0	$ 0.00
SCHOOLBUS	$ 7.00	0	$ 0.00
TRUCK DMP	$ 14.00	0	$ 0.00
TRUCK SEMI	$ 14.00	0	$ 0.00
TRUCK TNKER	$ 14.00	0	$ 0.00
TRUCK LOG LRGE	$ 22.50	0	$ 0.00
LRGE DOLL	$ 15.00	0	$ 0.00
SMALL DOLL W/NG	$ 14.00	0	$ 0.00
DOLLBED W/BLK	$ 13.50	0	$ 0.00
DOLL CRADLE	$ 30.00	0	$ 0.00
LRGE CANNON	$ 4.00	0	$ 0.00
SM CANNON	$ 2.50	0	$ 0.00
DEC PILLOW	$ 4.00	0	$ 0.00
CAT STFD	$ 3.00	0	$ 0.00
PLAQUE/CAR	$ 4.00	0	$ 0.00
ANIMAL CTS	$ 1.25	0	$ 0.00
PLAQUE/GUN	$ 25.00	0	$ 0.00
		MISMATCHED SALES	$ 12.50
		INVENTORY SALES	$ 31.00
		TOTAL SALES	$ 43.50

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MENU DRIVEN - No special commands to be learned. All functions are menu selected and aided by on screen instructions.

CAPACITY - Up to 255 characters per record, 24000 characters per file. (9000 with 16K)

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IP$ and IQ$ to the maximum number of line entries you want. Also, delete lines 7800 and 8500 and replace the *PRINT@* statements with *PRINTTAB* statements.

You can delete *REM* statements if you wish to save more memory. If your prices are printed with a percent sign (%) in front of them, it means that the *PRINTUSING* statements are too small. Add a crosshatch (#) to the statements as needed.

In line 1500, the first *POKE* is used to set the printer comma width. The second *POKE* is used with the *SCREEN* command to change the color of the screen if you use a black and white TV.

Once you get the program working properly, you can delete the *REMarks* and all spaces from the program to increase the amount of free memory.

I have included a Table Of Variables (Table 1) to assist you in modifying the program for your needs. Although the program is slow (because of the LP VII and cassette), I find that the amount of time saved in figuring my orders and profits as well as having a permanent record makes this program useful.

Figure 4
Sample of Inventory Data

INVENTORY DATA

INVENTORY ITEM	PRICE EA.
1 CESSNA 172	$18.50
2 STEARMAN	$22.50
3 F-86 SABRE	$ 5.00
4 C-130 HERCULES	$14.00
5 T-28 PLANE	$ 8.00
6 BIPLANE W/PROP	$14.00
7 DC-8 JET	$14.00
8 LRGE BIPLANE	$30.00
9 LRGE C-130	$25.00
10 SE5A BIPLANE	$16.00
11 LRGE HELICOPTER	$12.50
12 SM HELICOPTER	$10.00
13 FORD VAN	$ 7.00
14 TRUCK STKBD	$10.00
15 SPCAR MGA	$ 8.00
16 SEDAN 1930	$ 8.00
17 COUPE 1930	$ 8.00
18 SEDAN 1940	$ 8.00
19 BLAZER	$ 7.00
20 JEEP	$ 7.00
21 TR-7 CAR	$ 7.00
22 BLAZER W/BOAT	$14.00
23 JEEP W/CAMPER	$14.00
24 SCHOOLBUS	$ 7.00
25 TRUCK DMP	$14.00
26 TRUCK SEMI	$14.00
27 TRUCK TNKER	$14.00
28 TRUCK LOG LRGE	$22.50
29 LRGE DOLL	$15.00
30 SMALL DOLL W/NG	$14.00
31 DOLLBED W/BLK	$13.50
32 DOLL CRADLE	$30.00
33 LRGE CANNON	$ 4.00
34 SM CANNON	$ 2.50
35 DEC PILLOW	$ 4.00

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Table of Variables
(Numeric Variables)

B	reads numeric data statements
CT	daily total charges without tax
E1-E2	FOR-NEXT loop or error subroutine
F1-F2	program flags
I	used for any insignificant prompt inputs
IQ	quantity of item sold for customer receipts
IS(X)	quantity of item sold for inventory sales list
IT	total sales for inventory sales list
L	determines length of string variables
LP	loop values for reading data statements
MO	total amount of sales compiled in retrieve mode
MM	total mismatched sales for inventory sales list
TC	total charge per sale without tax
TQ	total quantity sold
TT	total sales tax per day
TX	state sales tax
T1-T9	screen tab settings
X,Y,Z	used in FOR-NEXT loops

Table of Variables
(String Variables)

A$	used to read string data
AD$	customer address
BN$	your business name
CC$	input for cassette copy prompt
DA$	date entered in compile mode or read in retrieve mode
I$	input for insignificant prompts
IL$	input for inventory list prompt
IP$(X)	price of item sold
IQ$(X)	quantity of item sold
IS$(X)	name of item sold
PC$	input for printer copy prompt
P1$-P7$	screen and printer codes
NO$	message for bottom of customer receipt
SP$	customer name
TN$	your business phone number

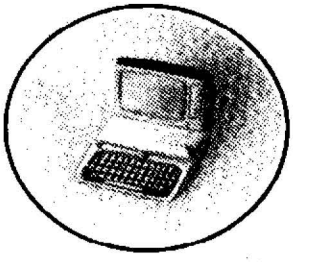
```
4600 .... 030A
6800 .... 055B
8400 .... 07A0
11000 ... 0AB6
13300 ... 0D85
16800 ... 11AB
20000 ....1527
22500 ....1817
END .... 1CF9
```

The listing:

```
1000 '     SALES REGISTER
1100 '     BY DENNIS H. WEIDE
1200 '     COPYRIGHT 1983
1300 '
1400 CLS:CLEAR 1000
1500 POKE 153,23:POKE 359,13:SCR
EEN 0,1
1600 '
1700 '     CONTROL CODES
1800 '
1900 P1$=STRING$(32,"*"):P2$=STR
ING$(32,32):P3$=CHR$(10):P4$=CHR
$(31)
2000 P5$=CHR$(30):P6$=STRING$(80
,"-"):P7$=STRING$(40,"#")
2100 '
2200 '     BUSINESS NAME
2300 '
2400 BN$="D&M WOOD PRODUCTS"
2500 '
2600 '     STATE GROSS RECEIPTS T
AX
2700 '
ISTER
1100 '     BY DENNIS H. WEIDE
1200 '     COPYRIGHT 1983
1300 '
1400 CLS:CLEAR 1000
1500 POKE 153,23:POKE 359,13:SCR
EEN 0,1
1600 '
1700 '     CONTROL CODES
1800 '
1900 P1$=STRING$(32,"*"):P2$=STR
ING$(32,32):P3$=CHR$(10):P4$=CHR
$(31)
2000 P5$=CHR$(30):P6$=STRING$(80
,"-"):P7$=STRING$(40,"#")
2100 '
2200 '     BUSINESS NAME
2300 '
2400 BN$="D&M WOOD PRODUCTS"
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```
2500 '
2600 '     STATE GROSS RECEIPTS T
AX
2700 '
2800 TX=.04
2900 '
3000 '     BUSINESS PHONE NUMBER
3100 '
3200 TN$="PH 505+293-5228"
3300 NO$="WE GUARANTEE YOUR SATI
SFACTION"
3400 '
3500 '     DETERMINE INVENTORY LI
ST LENGTH
3600 '
3700 READ A$,B:X=X+1
3800 IF A$="END" THEN LP=X-1 ELS
E 3700
3900 DIM IS(LP)
4000 '
4100 '     DISPLAY MENU
4200 '
4300 CLS:PRINT P1$;:PRINTTAB(9)"
SALES RECORD "
4400 PRINTTAB(7)"BY DENNIS H. WE
IDE"
4500 PRINTTAB(9)"COPYRIGHT 1983"
4600 PRINT P1$
4700 PRINT:PRINTTAB(10)"PROGRAM
MENU"
```

RAINBOWfest Seminar Talks Available On Tape

Copies of all seminars given at RAINBOWfest are now available on audio tape.

In addition, a tape is available of the keynote breakfast speech given by Don Inman. Seminars were given by Fred Scerbo of IMB on educational software; E.R. Bailey of Micrologic on faster Basic; Dr. Hal Snyder of the Northern Illinois Color Computer Club on assembly language techniques; Tom Nelson of Nelson Software on legal aspects of software marketing; Steve Bjork of Datasoft on assembly language graphics; Charles Roslund of Elite Software on machine language utilities and a cooperative session for CoCo clubs with Lonnie Falk of *the Rainbow*. Each session lasted over an hour.

Tapes are $5 each, or all eight for $35. There is a $1.50 shipping and handling charge, whether you buy one or all of them.

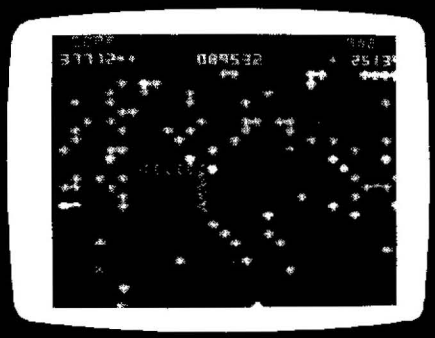
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```
4800 PRINT:PRINTTAB(5)"1. COMPIL
E SALES DATA"
4900 PRINTTAB(5)"2. RETRIEVE SAL
ES DATA"
5000 PRINTTAB(5)"3. READ INVENTO
RY DATA"
5100 PRINT:PRINTTAB(9)"";:INPUT"
WHICH ONE";I
5200 CLS
5300 ON I GOTO 5900,12900,21100
5400 CLS:GOSUB 18500:GOTO 4300
5500 PRINT IS$(Y),IP$(Y),IQ$(Y)
5600 '
5700 '     COMPILE SALES DATA
5800 '
5900 INPUT "ENTER TODAY'S DATE";
DA$
6000 PRINT:INPUT"PRINTER COPY (Y
/N)";PC$
6100 PRINT:INPUT"MAG TAPE COPY (
Y/N)";CC$
6200 CLS:IF PC$="Y" THEN 6300 EL
SE 6400
6300 PRINT:PRINTTAB(1) "TURN PRI
NTER ON AND SET PAPER":PRINT
6400 IF CC$="Y" THEN 6500 ELSE 6
700
6500 PRINTTAB(10)"LOAD CASSETTE"
6600 PRINT:PRINTTAB(4)"PRESS <PL
AY> & <RECORD>"
6700 GOSUB 19900
6800 CLS:X=1:TQ=0:TC=0:PRINTTAB(
1)"SOLD TO"
6900 PRINTTAB(1)"ADDRESS":PRINT
P1$;
7000 PRINTTAB(1)"ITEM";TAB(15)"Q
UAN";TAB(23)"PRICE EA":PRINT P1$
7100 PRINT@10,"";:LINE INPUT SP$
7200 IF SP$="START" AND PC$="Y"
THEN 7300 ELSE 7400
7300 PRINT#-2,P4$;P7$;"START OF
DATA";P5$:GOTO 9600
7400 IF SP$="END" AND PC$="Y" TH
EN 7500 ELSE 7600
7500 PRINT#-2,P4$;P7$;"END OF DA
TA";P5$:GOTO 9600
7600 IF SP$="TOTAL" THEN 19100 E
LSE IF SP$="MENU" THEN 4300
7700 PRINT@42,"";:LINE INPUT AD$
7800 T1=161:T2=184:T3=177
7900 PRINT@T1,"";:LINE INPUT IS$
(X):PRINT@T3,"";
8000 LINE INPUT IQ$(X):PRINT@T2,
"";:LINE INPUT IP$(X)
8100 PRINT@T2-2,USING"$#####.##";
VAL(IP$(X))*VAL(IQ$(X))
8200 I$=INKEY$:IF I$="" THEN 820
0
8300 IF I$="E" THEN PRINT@T1,P2$
```

Setting The Standards

WHAT THEY ARE SAYING ABOUT COLORPEDE

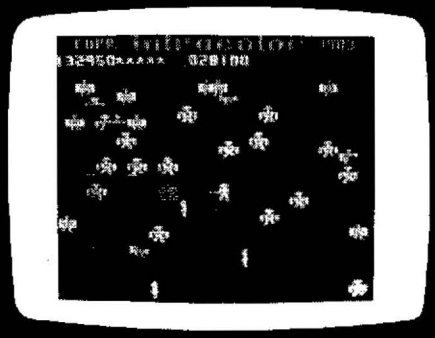
"...front of the pack..." the Rainbow, Dec. '82 "...an outstanding program..." N. Vernon, IN "...packed graphics..." Erie, PA
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```
:GOTO 7900
8400 TC=TC+(VAL(IP$(X))*VAL(IQ$(
X))):TQ=TQ+VAL(IQ$(X))
8500 T1=T1+32:T2=T2+32:T3=T3+32
8600 IF ASC(I$)=13 THEN 8700 ELS
E X=X+1:GOTO 7900
8700 PRINTTAB(22)"---------":PRI
NTTAB(12)"SUBTOTAL";TAB(22)"";
8800 PRINTUSING"$####.##";TC
8900 PRINTTAB(12)"TAX";TAB(22)""
;:PRINTUSING"$####.##";TX*TC
9000 PRINTTAB(22)"---------":PRI
NTTAB(12)"TOTAL";TAB(22)"";
9100 PRINTUSING"$####.##";TC+(TX
*TC):PRINT:PRINT
9200 TT=TT+(TC*TX):CT=CT+TC
9300 '
9400 '     CASSETTE COPY OF DATA
9500 '
9600 IF CC$="Y"THEN 9700 ELSE 10
300
9700 OPEN"O",#-1,"DATA"
9800 PRINT#-1,X,SP$,AD$:FORY=1 T
O X:PRINT#-1,IS$(Y),IP$(Y),IQ$(Y
):NEXT
9900 PRINT#-1,DA$,TC,TT,CT:CLOSE
-1
10000 '
10100 '     PRINTER COPY OF SALES
10200 '
10300 IF PC$="Y" THEN 10400 ELSE
 12400
```


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```
10400 IF SP$="START" OR SP$="END
" THEN 12400
10500 PRINT#-2,P4$:L=(40-LEN(BN$
))/2
10600 PRINT#-2,TAB(L);BN$;P3$;P3
$
10700 L=(40-LEN(TN$))/2:PRINT#-2
,TAB(L);TN$;P3$;P3$
10800 L=(40-LEN(SP$))/2:PRINT#-2
,TAB(L);SP$
10900 L=(40-LEN(AD$))/2:PRINT#-2
,TAB(L);AD$;P3$;P3$
11000 L=(40-LEN(DA$))/2:PRINT#-2
,TAB(L);DA$;P3$;P5$
11100 FOR Y=1 TO X
11200 PRINT#-2,TAB(20)IS$(Y);TAB
(40);"(";VAL(IQ$(Y));")";TAB(50)
"";
11300 PRINT#-2,USING"$####.##";V
AL(IP$(Y))*VAL(IQ$(Y)):NEXT Y
11400 PRINT#-2,TAB(41)"---";TAB(
50)"--------"
11500 PRINT#-2,TAB(20)"SUBTOTAL"
;TAB(41);TQ;TAB(50)"";
11600 PRINT#-2,USING"$####.##";T
C
11700 PRINT#-2,TAB(20)"SALES TAX
";TAB(50)"";:PRINT#-2,USING"$###
#.##";TC*TX
11800 PRINT#-2,TAB(50)"--------"
11900 PRINT#-2,TAB(20)"TOTAL";TA
B(50)"";
12000 PRINT#-2,USING"$####.##";T
C+(TC*TX)
12100 PRINT#-2,P3$;P3$;P4$
12200 L=(40-LEN(NO$))/2:PRINT#-2
,TAB(L);NO$;P5$
12300 PRINT#-2,STRING$(5,10)
12400 FOR Y=1 TO X:IP$(Y)="":IS$
(Y)="":IQ$(Y)=""
12500 NEXT Y:X=0:GOSUB 19900:GOT
O 6800
12600 '
12700 '     RETRIEVE DATA
12800 '
12900 CLS:PRINT:INPUT"PRINTER CO
PY (Y/N)";PC$
13000 PRINT:INPUT"INVENTORY LIST
 (Y/N)";IL$
13100 CLS:IF PC$="Y" THEN 13200
ELSE 13300
13200 PRINT#-2,P3$;P3$;P4$:PRINT
#-2,TAB(15);"SALES DATA";P3$;P3$
;P5$
13300 OPEN"I",#-1,"DATA"
13400 INPUT#-1,X,SP$,AD$
13500 IQ=0:FOR Y=1 TO X
13600 INPUT#-1,IS$(Y),IP$(Y),IQ$
(Y):IQ=IQ+VAL(IQ$(Y))
```



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```
13700 NEXT Y:INPUT#-1,DA$,TC,TT,
CT:CLOSE-1
13800 MO=0:PRINT:PRINT"SOLD TO "
SP$:PRINT:FOR X=1 TO Y-1
13900 PRINTTAB(2);VAL(IQ$(X));TA
B(5);IS$(X);TAB(24);
14000 PRINTUSING"$###.##";VAL(IP
$(X))*VAL(IQ$(X))
14100 MO=MO+(VAL(IP$(X))*VAL(IQ$
(X))):NEXT X
14200 PRINTTAB(24)"--------":PRIN
TTAB(15)"SUBTOTAL";TAB(24)"";
14300 PRINTUSING"$###.##";MO
14400 PRINTTAB(15)"TAX";TAB(24)"
";
14500 PRINTUSING"$###.##";MO*TX
14600 PRINTTAB(24)"--------"
14700 PRINTTAB(15)"TOTAL";TAB(24
)"";
14800 PRINTUSING"$###.##";MO+(MO
*TX):PRINT
14900 IF IL$="Y" THEN GOSUB 2030
0
15000 IF PC$="Y" THEN 15400 ELSE
 17800
15100 '
15200 '     PRINTER COPY OF DATA
15300 '
15400 PRINT#-2,P4$;P7$;P3$:PRINT
#-2,DA$;P3$
15500 IF SP$="START" THEN PRINT#
-2,"START OF DATA":GOTO 17700
15600 IF SP$="END" THEN PRINT#-2
,"END OF DATA":GOTO 17700
15700 PRINT#-2,"SOLD TO  ";SP$
15800 PRINT#-2,"ADDRESS  ";AD$
15900 PRINT#-2,P5$;P3$
16000 IF LEFT$(SP$,5)="START" OR
 LEFT$(SP$,3)="END" THEN 16100 E
LSE 16200
16100 PRINT#-2,SP$:GOTO 17800
16200 PRINT#-2,"  ITEM SOLD","QU
ANTITY","PRICE EA.","TOTAL PRICE
"
16300 PRINT#-2,P6$
16400 FOR Y=1 TO X-1
16500 PRINT#-2,IS$(Y),:PRINT#-2,
USING"####";VAL(IQ$(Y)),:PRINT#-
2,"",
16600 PRINT#-2,USING"$#####.##";V
AL(IP$(Y)),
16700 PRINT#-2,"",:PRINT#-2,USIN
G"$#####.##";VAL(IP$(Y))*VAL(IQ$(
Y))
16800 NEXT Y
16900 PRINT#-2,,,,"---------"
17000 PRINT#-2,"DAILY SUBTOTAL",
:PRINT#-2,USING"$#####.##";CT,
17100 PRINT#-2,,"SUBTOTAL",:PRIN
T#-2,USING"$#####.##";TC
17200 PRINT#-2,"DAILY TAX",:PRIN
T#-2,USING"$#####.##";TT,
17300 PRINT#-2,,"TAX",:PRINT#-2,
USING"$#####.##";TX*TC
17400 PRINT#-2,,"---------",,"---
------":PRINT#-2,"DAILY TOTAL",
17500 PRINT#-2,USING"$#####.##";T
T+CT,:PRINT#-2,,"TOTAL",
17600 PRINT#-2,USING"$#####.##";T
C+(TC*TX)
17700 PRINT#-2,P3$;P3$;P3$;P3$
17800 IF LEFT$(SP$,3)="END" THEN
 PRINT:GOTO 18000
17900 GOTO 13300
18000 IF IL$="Y" THEN GOSUB 2240
0
18100 GOSUB 19900:CLS:GOTO 4300
18200 '
18300 '     ERROR SUBROUTINE
18400 '
18500 FOR E1=1 TO 5
18600 CLS:PRINT@233,"ILLEGAL ENT
RY"
18700 SOUND 100,5:CLS:FOR E2=1 T
O 50:NEXT E2,E1:CLS:RETURN
18800 '
18900 '     DISPLAY TOTALS
19000 '
19100 CLS:PRINT:PRINTTAB(5)"TOTA
```


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```
L SALES FOR TODAY":PRINT:PRINT
19200 PRINTTAB(5)"TOTAL SALES  "
;:PRINTUSING"$$####.##";CT
19300 PRINT:PRINTTAB(5)"TOTAL TA
X    ";:PRINTUSING"$$####.##";TT
19400 PRINT:PRINTTAB(5)"GRAND TO
TAL  ";:PRINTUSING"$$####.##";CT+
TT
19500 GOSUB 19900:GOTO 6800
19600 '
19700 '     SUBROUTINES
19800 '
19900 PRINT@450,"PRESS <ENTER> T
O CONTINUE";:INPUT I$:RETURN
20000 '
20100 '     INVENTORY COUNT
20200 '
20300 FOR Y=1 TO X-1:RESTORE:F2=
0:FOR Z=1 TO LP:READ A$,B
20400 IF A$=IS$(Y) THEN IS(Z)=IS
(Z)+VAL(IQ$(Y)):F2=1
20500 NEXT Z
20600 IF F2=0 THEN IS$(Y)=IS$(Y)
+P4$+" #"+P5$:MM=MM+VAL(IP$(Y))*
VAL(IQ$(Y))
20700 NEXT Y:RETURN
20800 '
20900 '     DATA STATEMENT PRINTO
UT
21000 '
21100 CLS:F1=0:PRINT:INPUT"PRINT
ER COPY (Y/N)";PC$:CLS
21200 IF PC$="Y" THEN 21300 ELSE
 21500
21300 PRINT#-2,P4$;P3$;P3$:PRINT
#-2,TAB(13)"INVENTORY DATA";P3$;
P5$
21400 PRINT#-2,P3$;P3$:PRINT#-2,
"INVENTORY ITEM",,"PRICE EA.":PR
INT#-2,P6$
21500 RESTORE:FOR X=1 TO LP:READ
 A$,B
21600 PRINTA$,:PRINTUSING"
 $$###.##";B
21700 IF PC$="Y" THEN 21800 ELSE
 22000
21800 PRINT#-2,X;A$,,"";:PRINT#-
2,USING"$$###.##";B
21900 F1=F1+1:IF F1=5 THEN PRINT
#-2,P6$:F1=0
22000 NEXT:RESTORE:PRINT:PRINT:G
OSUB 19900:CLS:GOTO 4300
22100 '
22200 '     INVENTORY PRINTOUT
22300 '
22400 RESTORE:IT=0:PRINT#-2,P3$;
P3$;P4$
```


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```
225ØØ PRINT#-2,TAB(8)"INVENTORY
SALES LIST";P3$;P3$;P5$
226ØØ PRINT#-2,"  INVENTORY","
PRICE","QUANTITY","  TOTAL"
227ØØ PRINT#-2,"    ITEM","   EA
.","  SOLD","  PRICE"
228ØØ PRINT#-2,P6$
229ØØ F1=Ø:FOR X=1 TO LP:READ A$
,B
23ØØØ PRINT#-2,A$,:PRINT#-2,USIN
G"$###.##";B,:PRINT#-2,"",
231ØØ PRINT#-2,USING"#####";IS(X
),:PRINT#-2,"",
232ØØ PRINT#-2,USING"$####.##";B
*IS(X)
233ØØ F1=F1+1:IF F1=5 THEN PRINT
#-2,P6$:F1=Ø
234ØØ IT=IT+(B*IS(X)):IS=IS+IS(X
)
235ØØ NEXT X:PRINT#-2,P6$
236ØØ PRINT#-2,,,"MISMATCHED SAL
ES",:PRINT#-2,USING"$####.##";MM
237ØØ PRINT#-2,,,"INVENTORY SALE
S",:PRINT#-2,USING"$####.##";IT
238ØØ PRINT#-2,,,,"--------"
239ØØ PRINT#-2,,,"TOTAL SALES",:
PRINT#-2,USING"$####.##";MM+IT
24ØØØ RETURN
241ØØ '
242ØØ '    DATA STATEMENTS
243ØØ '
244ØØ DATA CESSNA 172,18.5Ø,STEA
RMAN,22.5Ø,F-86 SABRE,5.ØØ,C-13Ø
 HERCULES,14.ØØ,T-28 PLANE,8.ØØ,
BIPLANE W/PROP,14.ØØ,DC-8 JET,14
.ØØ,LRGE BIPLANE,3Ø.ØØ,LRGE C-13
Ø,25.ØØ,SE5A BIPLANE,16.ØØ
245ØØ DATA LRGE HELICOPTER,12.5Ø
,SM HELICOPTER,1Ø.ØØ,FORD VAN,7.
ØØ,TRUCK STKBD,1Ø.ØØ,SPCAR MGA,8
.ØØ,SEDAN 193Ø,8.ØØ,COUPE 193Ø,8
.ØØ,SEDAN 194Ø,8.ØØ,BLAZER,7.ØØ,
JEEP,7.ØØ,TR-7 CAR,7.ØØ
246ØØ DATA BLAZER W/BOAT,14.ØØ,J
EEP W/CAMPER,14.ØØ,SCHOOLBUS,7.Ø
Ø,TRUCK DMP,14.ØØ,TRUCK SEMI,14.
ØØ,TRUCK TNKER,14.ØØ,TRUCK LOG L
RGE,22.5Ø,LRGE DOLL,15.ØØ,SMALL
DOLL W/NG,14.ØØ,DOLLBED W/BLK,13
.5Ø
247ØØ DATA DOLL CRADLE,3Ø.ØØ,LRG
E CANNON,4.ØØ,SM CANNON,2.5Ø,DEC
 PILLOW,4.ØØ,CAT STFD,3.ØØ,PLAQU
E/CAR,4.ØØ,ANIMAL CTS,1.25,PLAQU
E/GUN,25.ØØ
248ØØ DATA END,Ø
```


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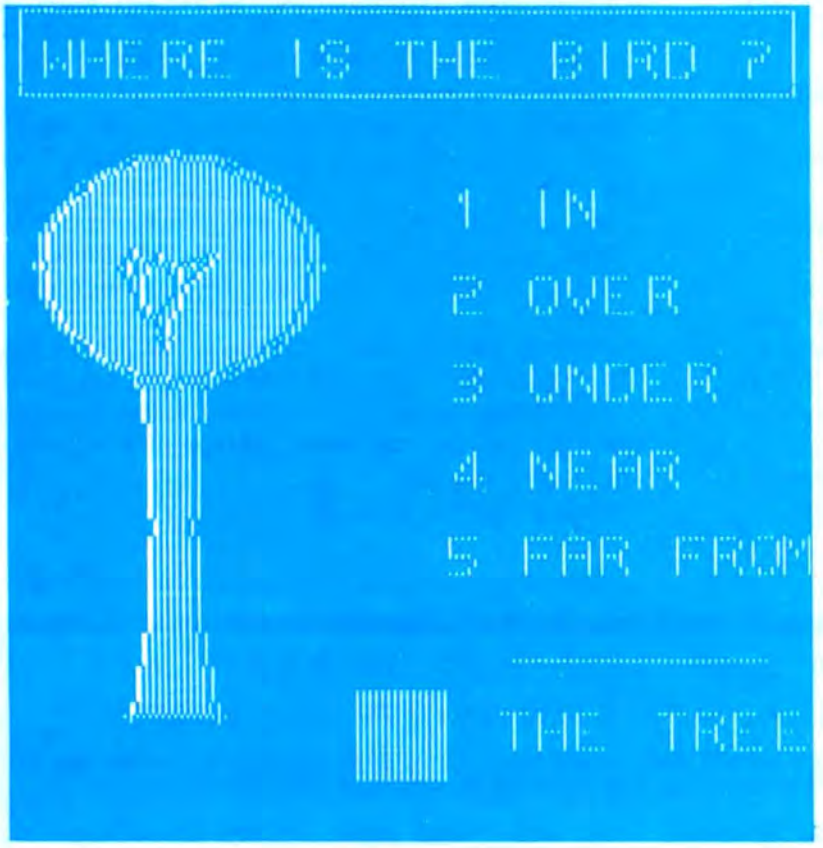
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By Steve Blyn

Young children are often confused by the concepts of up-down, near-far, over-under, and the like. It brings to mind an incident I experienced with one of my children. He came to me (age two), arms raised, and said, "Pick me down." I laughed, lifted him, and said, "You mean, 'pick me up.'" Then, as now, he was a kid with a mind of his own. He gave me a dirty look, pointed to the floor, and said, "Put me up!" Needless to say, he has since mastered the concepts of up and down. Perhaps if we had the Color Computer back in the early '70s the two of us could have had some fun viewing this concept graphically displayed on the screen.

The learning of concepts in children has always fascinated me. Because I am both a parent and a teacher, I am always anxious to use the computer to help children develop childrens' reasoning abilities.

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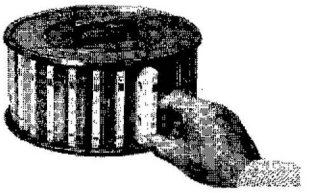
(Steve Blyn teaches both exceptional and gifted children, holds two master's degrees and has won awards for the design of programs to aid the handicapped. He and his wife, Cheryl, own Computer Island.)

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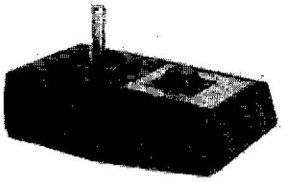


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The above general description is applicable to the growth of many concepts in children. The Color Computer can especially be an aid to children in concept formation. The graphics, colors and sounds can help them to visualize many concepts with unique presentations.

The program that follows gives the young child practice in developing the concepts of near-far, over-under, and in-out. The child playing this game decides whether the topics are merely examples of what can be done. You may decide to only use one concept at a time. Many other concepts can be worked on with other pictures and words. Left-right, north-south, big-bigger-biggest and small-smaller-smallest are other possibilities. Shapes can also be taught in a similar manner.

Lines 60-110 choose a random position for the bird to appear each time. Lines 130 to 450 draw the pictures and words. Lines 460-490 wait for the child's response. Lines 500-560 draw the response number the child pressed on the keyboard.

Lines 570-640 check the response. A correct response gets a happy sound and the next example begins. Incorrect responses get another turn at the same question. The child can keep guessing until he is correct. The fact that he can keep guessing repeatedly and there is no time limit or score are purposeful. I see no reason to impose any limits or constraints on a preschool child in this type of situation. The idea is to get the concepts across to him. We can make him a better game player some other time.

Lines 650-940 create strings to draw the letters and numbers needed in this program.

I can't overemphasize the importance of the teaching of such seemingly easy concepts as in and out. It is imperative that children be properly motivated if they are to retain the knowledge of these concepts. The Color Computer is certainly a means to achieving this end. Your children will grasp and maintain these concepts, and perhaps more importantly, they will have great fun in doing it. Can you imagine—learning and having fun at the same time!

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```
280.... 02E0
500.....0586
680.... 07F1
END.. 0ADD
```

The listing:

```
10 REM"BIRD"
20 REM  <C> STEVE BLYN,COMPUTER
ISLAND,N.Y. 1983
30 CLEAR1000
40 TM=RND(-TIMER):REM"THIS GETS
A TRUE RANDOM FOR THE COCO"
50 A=RND(5)
60 REM"RANDOMLY CHOOSE THE BIRD'
S POSITION EACH TIME AND LOCATE
THE COORDINATES"
70 IF A=2 THEN X=-8:Y=135
80 IF A=1 THEN X=30:Y=100
90 IF A=3 THEN X=X+15:Y=Y-10
100 IF A=4 THEN X=X+60:Y=Y+30
110 IF A=5 THEN X=X+205:Y=Y+115
120 GOTO 660:REM"READ THE NUMBER
S AND LETTERS"
130 PMODE 3,1:PCLS5:SCREEN1,1
140 COLOR2
150 CIRCLE(55,60),45,2,.6
160 CIRCLE(55,60),46,2,.6
170 CIRCLE(55,60),47,2,.6
180 PAINT(60,60),2,2
190 CIRCLE(7,120),40,2,2,.93,.10
200 CIRCLE(99,120),40,2,2,.41,.5
9
210 LINE(36,163)-(68,163),PSET
220 PAINT(55,160),2,2
230 REM"DRAWING THE BIRD"
240 COLOR3:CIRCLE(10+X,160-Y),5
250 CIRCLE(18+X,165-Y),8
260 PAINT(18+X,165-Y),3,3
270 LINE(24+X,160-Y)-(36+X,157-Y
),PSET
280 LINE-(20+X,169-Y),PSET
290 LINE-(20+X,176-Y),PSET
300 CIRCLE(20+X,176-Y),2
310 FORT=1 TO5:PLAY"O5L200BCB;L2
50;G-;L100;C":NEXTT
320 LINE(5,1)-(250,20),PSET,BF
```

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```
330 DRAW "C1A0S4BM20,16"+W$+H$+E
$+R$+E$
340 DRAW SP$+I$+S$
350 DRAW SP$+T$+H$+E$
360 DRAW SP$+B$+I$+R$+D$+SP$+QQ$
370 REM"PRINT THE WORDS**IN,OVER
,UNDER,NEAR,FAR FROM THE TREE"
380 DRAW"C4BM130,40"+A1$+SP$+I$+
N$
390 DRAW"BM130,60"+A2$+SP$+O$+V$
+E$+R$
400 DRAW"BM130,80"+A3$+SP$+U$+N$
+D$+E$+R$
410 DRAW"BM130,100"+A4$+SP$+N$+E
$+A$+R$
420 DRAW"BM120,120"+A5$+SP$+F$+A
$+R$+SP$+F$+R$+O$+M$
430 LINE(135,130)-(240,130),PSET
440 COLOR 3:LINE(106,163)-(125,1
47),PSET,BF
450 DRAW"BM145,140"+T$+H$+E$+SP$
+T$+R$+E$+E$
460 JJ$=INKEY$
470 FOR T= 1 TO 200: NEXT T
480 COLOR2:LINE(106,163)-(125,14
7),PSET,BF
490 IF JJ$="" THEN 460
500 IF JJ$="1" THEN KK$=A1$
510 IF JJ$="2" THEN KK$=A2$
520 IF JJ$="3" THEN KK$=A3$
530 IF JJ$="4" THEN KK$=A4$
540 IF JJ$="5" THEN KK$=A5$
550 REM"DRAW CHILD'S RESPONSE #"
560 DRAW "C0BM112,159"+KK$
570 JJ=VAL(JJ$)
580 IF JJ<1 OR JJ>5 THEN 460
590 IF JJ$="1" AND A=1 THEN 600
ELSE IF JJ$="2" AND A=2 THEN 600
 ELSE IF JJ$="3" AND A=3 THEN 60
0 ELSE IF JJ$="4" AND A=4 THEN 6
00 ELSE IF JJ$="5" AND A=5 THEN
600 ELSE 620
600 FOR T=1 TO 5:PLAY"O4;L250;GE
FBAG":NEXTT
610 RUN
620 REM"WRONG RESPONSE ROUTINE"
630 FOR T=1TO3:SOUND10,4:NEXTT
640 DRAW"C3A0S4BM140,170"+L$+O$+
O$+K$+SP$:DRAW A$+G$+A$+I$+N$:GO
TO460
650 REM"THE DIRECTIONS TO DRAW L
ETTERS AND NUMBERS NEEDED"
660 A$="U8R8D4L8BR8D4BR4"
670 B$="U8R6F2D2L8BR8D2G2L6BR12"
680 D$="U8R6F2D4G2L6BR12"
690 E$="U8R8BD4L8BD4R8BR4"
700 F$="U8R8BD4L8BD4BR12"
710 G$="U8R8BD4L4BR4D4L8BR12"
720 H$="U8BR8D8BU4L8BD4BR12"
730 I$="BU8R8BL4D8BL4R8BR4"
740 K$="U8BR8G4L4BR4F4BR4"
750 L$="U8BD8R8BR4"
760 M$="U8F4E4D8BR4"
770 N$="U8F8U8BD8BR4"
780 O$="U8R8D8L8BR12"
790 P$="U8R8D4L8BD4BR12"
800 R$="U8R8D4L8BR4F4BR4"
810 S$="BU4U4R8BD4L8BR8D4L8BR12"
820 T$="BU8R8BL4D8BR8"
830 U$="U8BR8D8L8BR12"
840 V$="BU8D4F4E4U4BD8BR4"
850 W$="U8BR8D8H4G4BR12"
860 E0$=E0$
870 QQ$="BR1H1U1E1R3E2U1H2L5
880 A1$="BR2R4L2U8G2BD6BR10"
890 A2$="BR1H1U1E1R5E2U1H2L4G2BD
6BR1R7BR4"
900 A3$="BR1HBU6E1R6F1D2G1L4R4F1
D2G1L6BR11"
910 A4$="BU4U4BR4BD1D3R4L8R4D4BR
8"
920 A5$="BR1H1BU2U4E1R6F1BD2BL1L
6G1BD4BR1R6E1U3H1BD5BR5"
930 SP$="BR12":REM "SPACER"
940 AQ$="BENR3HER2U2":REM "?"
950 GOTO 130
```


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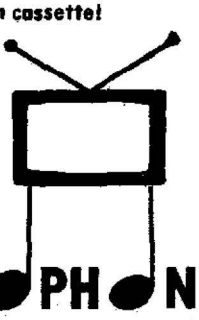
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Software Review

Dynacalc Is Highly Sophisticated Spreadsheet

Radio Shack has some tough competition in the electronic spreadsheet market. *Dynacalc*, by Computer Systems Center, is a second generation *Visicalc* program available for the CoCo. First of all, let me say that there is no way you can give a program of this caliber the credit due in a review. I would classify *Dynacalc* as sophisticated business software. Don't let that scare you. I guess the proper perspective is the reality that software formerly available only on minis and business systems is hitting the hobby market. Personally, I am glad to see it. I can visualize someone using a CoCo for a small business, but I can also see the need for this type of program in the home.

Dynacalc is designed to operate under the *Flex* disk operating system, therefore, it requires 64K and at least one disk drive. Two drives are recommended, but as the manual states, if you are used to operating with one drive you will have no more difficulty than usual. A 51 x 24 screen is used for all output, therefore, you must have a late version of *Flex*. Use of a printer is optional, but any printer that will work with *Flex* will also work with this program. The program is supplied on a nonprotected disk and it is recommended that the master only be used to make working copies. An updated version is available from CSC if you return the diskette within 90 days with proof of purchase. The documentation is excellent and well structured for the beginning user. Several example programs are included for familiarization. Three utility programs are also included for customizing printer/textfile parameters as well as disabling the HELP messages. The HELP messages are necessary for beginners but consume memory for advanced users.

Dynacalc simulates a 256 row by 256 column accounting type worksheet. Stop. How can a 64K computer hold a 256 x 256 worksheet? It can't. Under normal operation the program has approximately 30K of workspace, or close to 3000 cells. A memory indicator is on line 2 of the screen. A cursor indicates which cell (row, column) is in use. The cursor can be moved by the arrow keys or a *GOTO* command for longer moves. The cursor address always appears in the top left hand corner of the worksheet. Three types of data can be stored in any cell, values (numeric constants), expressions (mathematical operations) or labels (messages). You can edit the value of a cell at any time. In addition to data, there is a command structure of single letter entries that can be accessed by a /X entry while in the ready mode. These commands are called "Attributes." Rather than explain each command, a list of Functions and Commands is included for familiarization. A few of the more powerful commands will be highlighted.

@INDEX and @LOOKUP—Compare a supplied value with a value in the table. @INDEX looks for an exact match. @LOOKUP checks for a "greater than" condition. These functions allow sorting and are fast. An example program is provided to illustrate their operation.

@STDDEV—Calculates the standard deviation.
@NPV—Net present value.
@AVERAGE—Average or arithmetic mean.
@CHOOSE—Select a value from a list of two or more values.
@ROUND—Reduce the precision of values.
/F$—Represent values in dollars and cents.
/FP—Plot horizontal graphs on your worksheet.
/?—Help command.

Well, we could go through the whole list but that's what the 46 page instruction manual is for. One interesting command allows *Flex* to be accessed while still using *Dynacalc* for commands such as PROT, CAT, NEWDISK, etc., as long as the command does not use low memory.

For those of you with *Visicalc* experience, a command cross reference table is included in the manual. Also several reference books are recommended with comments on specific strong points.

As I mentioned earlier a complete description of all of the features is impractical in a review. I am impressed with the operation and excellent instructions of this package. No bugs were encountered in the program. Several examples were called and executed. They were very helpful and well structured for the beginning user. My own budget program was executed with ease after the initiation. The cost of this program is a little above normal for home use but as they say, "You get what you pay for."

(Computer Systems Center, 13461 Olwe Blvd., Chesterfield, MO 63017, $200)

—Dan Downard

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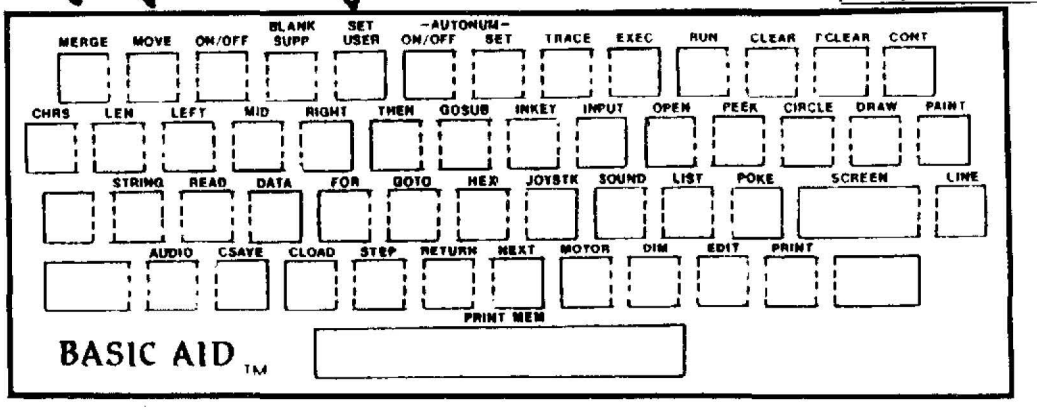
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ACOS(x)	arccosine
ASIN(x)	arcsine
ATAN(x)	arctangent
AVERAGE(x . . . y)	average value
CHOOSE(n,x . . . y)	value of the nth cell
COS(x)	cosine
COUNT(x . . . y)	number of cells
ERROR	>ER< error message
EXP(x)	e to the x power
INDEX(n,x . . . y,z)	value next to match
INT(x)	smallest integer
LN(x)	natural logarithm
LOG(x)	common logarithm
LOOKUP(n,x . . . y,z)	value next to mate
MAX(x . . . y)	greatest value
MIN(x . . . y)	smallest value
NA	not available
NPV(r,x . . . y)	present value
PI	3.141 . . .
ROUND(d,x)	x rounded to nearest d (10e-9 < d < 10e9)
SIN(x)	sine
SQRT(x)	square root
STDDEV(m,x . . . y)	standard deviation
SUM(x . . . y)	sum of cells
TAN(x)	tangent

Attributes

(B)ell
(D)eg.
(G)raph
(H)elp
(L)abel
(M)od.
(O)rder
(P)rint
  (B)orders
  (L)ines page
  (P)agination
  (S)pacing
  (W)idth
  (?)
(R)ecalc
(S)ize
(T)ype
(W)idth
  (C)olumn
  (W)indow
  (?)

Commands

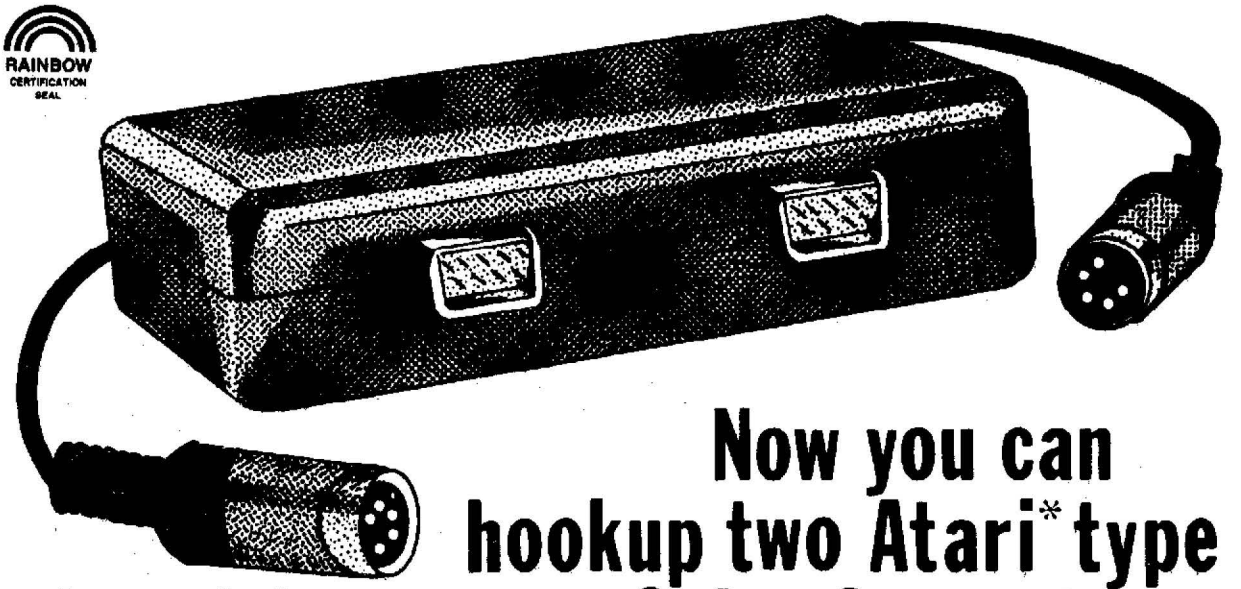
(B)lank Cell
(C)lear worksheet
(D)elete
(D)elete
  (C)olumn
  (R)ow
  (?)
(E)dit Cell
(F)ormat Cell
  (C)ontin.
  (D)efault
  (G)eneral
  (I)nteger
  (L)eft justify
  (P)lot
  (R)ight justify
  ($)dollar
  (?)
(I)nsert
  (C)olumn
  (R)ow
  (?)
(M)ove column or row
  (A)scending
  (D)escending
  (M)anual
  (?)
(O)utput to textfile
(P)rint on system printer
(Q)uit
  (F)lex
  (S)leep
  (?)
(R)eplicate
(S)ystem
  (L)oad
  (S)ave
  (X)ecute
  (#)data
    (L)oad
    (S)ave
    (?)
  (?)
(T)itles
  (B)oth
  (H)oriz.
  (N)one
  (V)ert
  (?)
(W)indows
  (D)isplay
  (F)ormat
  (H)oriz.
  (N)one
  (S)ync
  (U)nsync.
  (V)ert.
  (?)
(?) help

"BREAKING ALL SALES RECORDS"
Bob Rosen

"Recommend to anyone who enjoys games on his CoCo."
RAINBOW Review, March 1983

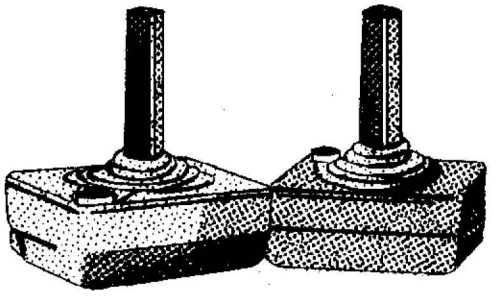
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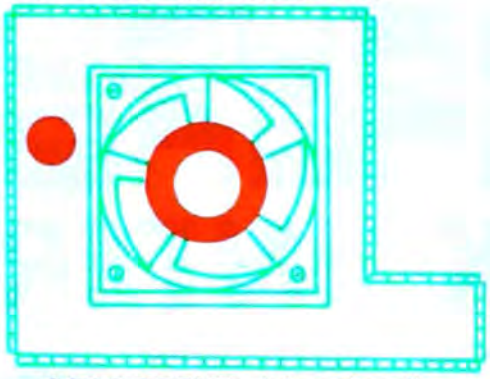
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WOODHAVEN, NY 11421
212·441·2807

COLOR CABLES +

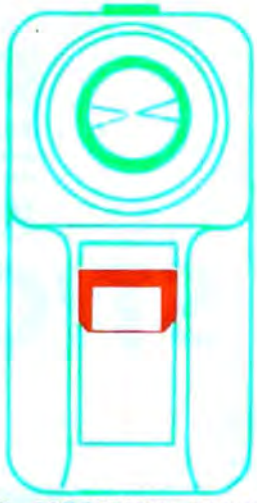
from SPECTRUM PROJECTS



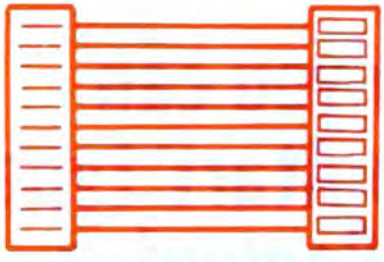
The must CoCo book for 1983. Contains a myriad of peeks and pokes. ROM and RAM upgrades, machine language backups, printer potpouri and more! Make your computer do things it never did before. $14.95



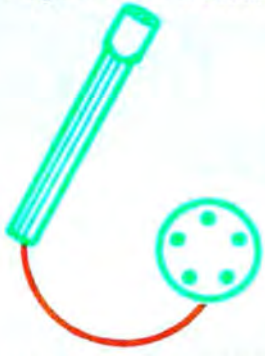
COCO COOLER—Internal cooling system. Prevent heat buildup inside your Color Computer. "CoCo Cooler keeps things cool."—Rainbow Review, Dec., 1982, Page 39 .....$49.95



THE SPECTRUM PADDLE—Enjoy quicker response and higher game scores. Great for games with side-to-side action like Astro Blast, Space Invaders, Shooting Gallery and Clowns and Balloons. Includes "softtouch" fire button. "You have better control of the right to left movement than with any joystick we have seen so far"—Rainbow Review, Jan., 1983, Page 134. .....$19.95



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DEL or EDIT
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COLOR COMPUTER EDITOR ASSEMBLER AND DEBUGGER

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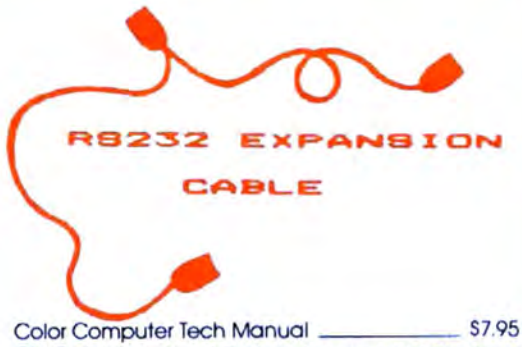
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PIPELINE

THE DRAGON CALLS Great Britain to mind first, but the truth of the matter is that our CoCo is gaining a lot of friends throughout the world. As that happens, of course, sales of Tandy's most popular computer continue to climb and, interestingly enough, so do sales of *the Rainbow*. Nowhere is this more evident than in England, which is blessed not only with the Color Computer, but with the Dragon-32 as well. With the exception of Australia, CoCo sales — based on *Rainbow* sales — were better in the British Isles than anywhere else. Now, of course, with Dragon, England is far and away the number one non-North American market for *the Rainbow* and, we suspect, the Color Computer, too.

That isn't to say that there isn't a good market elsewhere. No, we are not privy to Tandy's sales figures, but we can guess. And, we see some real strides in a number of places outside the United States. Canada, of course, is number one. One of the main advantages there is that the electricity is the same — which means there are no "special" needs that require different manufacturing for CoCo. Australia seems to be the "second" market with a number of other places —such as Mexico and Israel — close behind. Yet, we ship *the Rainbow* to some 40-odd countries each month. So, if *you* happen to be going abroad, check in at a Radio Shack (there are lots of them all across the world) and see if you can't find a fellow CoCo user. When you do, let us know. We'd like to share your impressions with others.

* * * * * *

COMPUSENSE OF ENGLAND has come up with a new utility called *DECODE* which allows BASIC programs to be cross-loaded between a CoCo and a Dragon-32. The machine language program is contained in a ROM Pack that will convert any program of 16K or smaller, so long as they do not use *POKE* or keyboard *PEEK* commands. It also does not work with disk. Information on this program can be obtained by writing to 11 Bury New Road, Prestwich, Manchester, England, M25 8JZ.

* * * * * *

According to reports we've been hearing, the CoCo market keeps getting stronger, but there is a shakeout ahead in the personal computer field. Fear not, there will be a Color Computer for quite a while yet — but don't bet on some of the other computers you may see being sold in chain stores and through discount houses. The reason seems to be a fight centering on price —and not everyone will be able to keep that going. With some of the marginal products now on the market (or ready to come to market) price was just about their only attraction. We do hope it won't end up being a cut-throat situation like that which existed in the digital watch field several years ago. No one came off as the winner in that one and very few will come off as winners in a personal computer price war, either.

As always, one of the big questions will be in the area of support. Tandy seems to recognize that one company alone cannot properly support *any* computer system. That just isn't so for many of the others and, while a point-of-sale display may look nice in a K-Mart for a computer like the VIC-20, the fact is that what you see is just about all there is available for that particular computer. Tandy has done some excellent marketing work on programs and other things for CoCo, but look where the market would be if that was all there was. We're sure that is why Tandy has established a support program for its computers. It is a wise move.

And, finally, suppose you *do* buy a Timex computer at a K-Mart or Walgreen's. Is the salesman in "Housewares" going to be able to explain a *FOR/NEXT* loop?

Even if you never plan to program, some of the ready-to-run programs *do* need to be explained. Because Radio Shack is able to get those explanations for you (at least when it is their own software), you can bet Radio Shack will be a force in computers for a long time to come.

* * * * * *

CHROMASETTE, THE FOLKS who came up with the first tape magazine for the CoCo, now will be doing it with disks, too. Disks go for $95 a year which appears to be just enough to cover the cost of the medium itself. Let's hand it to Dave Lagerquist, intrepid editor, too, for that little dash of humor that's always present in a Chromasette product. How do you get the menu? Just type in *RUN "AWAY"*! Orders can be sent to P.O. Box 1087, Santa Barbara, CA 93102 or phoned to (805) 963-1066.

* * * * * *

THE FOLKS AT ELITE Software have really been turning the old crank. For all practical purposes, Elite was contracted to write software for another firm until a couple of months ago. Then, on their own, they came out with *ZACKSUND*, followed with *ELITE*CALC* and now, we hear, they have some 20 more programs that will be ready for sale by summer.

* * * * * *

WE THINK IT IS a breakthrough, of sorts. A new program available from Computer Shack now allows you to transfer Model I, III and IV programs and data files to a CoCo disk. And, the reverse is true: You can transfer from CoCo to the Models I, III and IV. The program is called CIII and can be ordered for $24.95 from Computer Shack, 1691 Eason, Pontiac, MI 48054.

* * * * * *

AND SPEAKING OF breakthroughs, a cooperative effort between *the Rainbow* and AM Varityper Inc. now makes it possible to typeset ASCII files directly from a CoCo (or a Model 100 Portable Computer) to a Comp/Edit 5900 typesetting machine. "Normal" software is used on both ends of the connection, which uses a simple intelligent terminal program on CoCo and a telecommunications option available from AM.

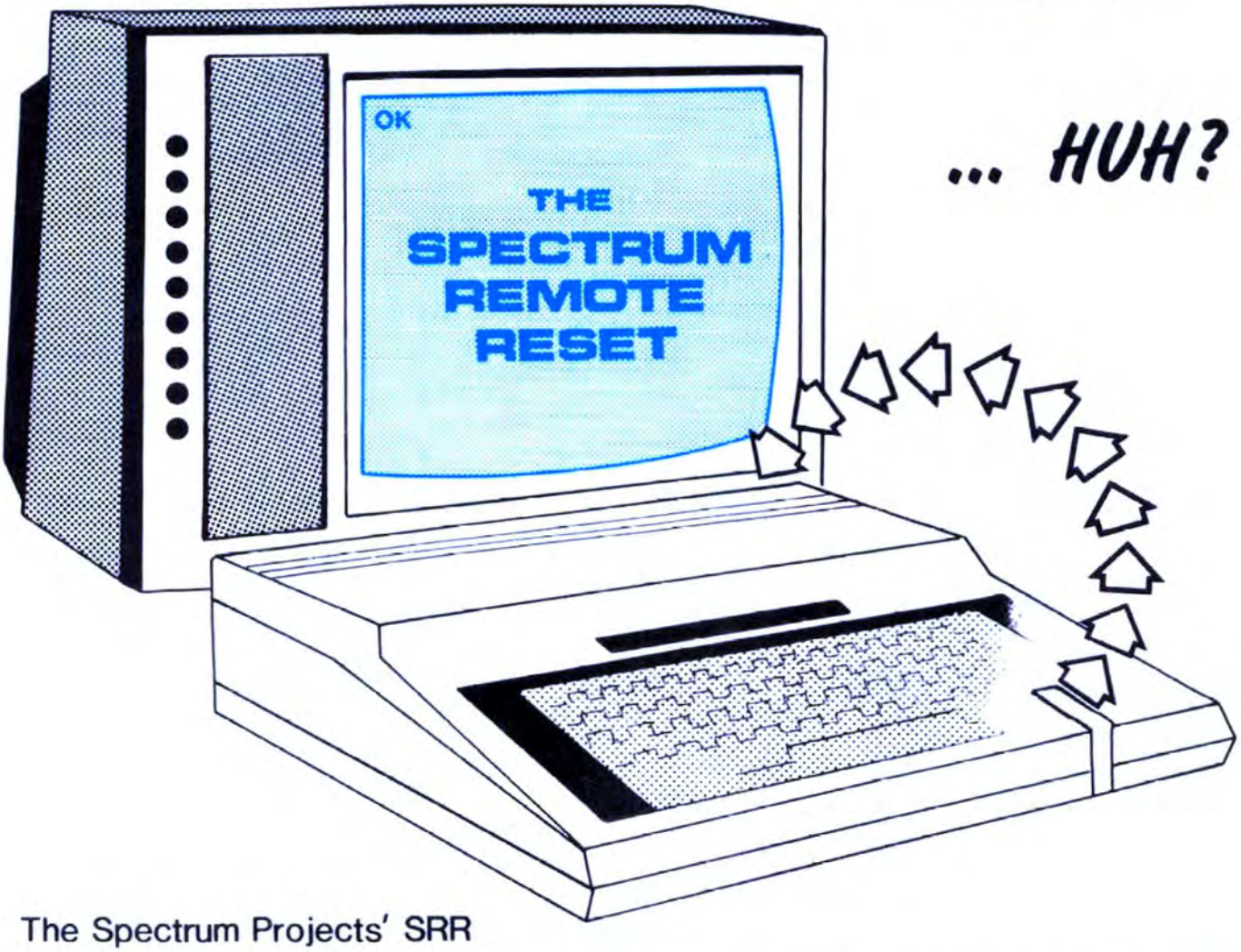
* * * * * *

A GOOF on our part last month— left out the information that Linda Nielson, author of the probability program in July's issue, is vice president of Moreton Bay Laboratory. Sorry, Linda.

* * * * * *

BY THE TIME YOU read this, we hear, a new wonder from Radio Shack will be appearing on the scene. Our understanding is that it will be a hardware device that allows several ROM Paks to be connected to CoCo at the same time and easily switched in and out. According to our sources, one of the primary reasons for developing this "expansion" device was to be able to use disk drives and the X-Pad at the same time. Price: We hear in the $170 range.

NOW... RESET THE BACK FROM THE FRONT.



The Spectrum Projects' SRR provides easy access to your system reset and eliminates the need of reaching around cables and components or moving the computer.

Installation of this sturdy device is simple, quick, requires no tools and voids no warranties.

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Only The SYSOP Can Kill Messages

One of these days I would like to see a psychological study of the effects of computer bulletin boards on modern society. Why would someone sit for several hours in front of a computer talking to another computer? Maybe it's the fact that you are controlling your own little empire on the screen. I'll have to admit there is a certain satisfaction in "downloading" a picture of Charlie Brown. Or, how about that new BASIC patch on CompuServe?

In reality, I think electronic mail is fast becoming a necessity—not only due to the fact that you can leave a message for anyone at anytime, but most of the time their telephone is busy since they're talking to a Bulletin Board, too. I predict that within 10 years there will be a computer in every household with a modem connected to some kind of time-sharing device. Pay your bills, order your groceries, plan your vacation, buy a new computer, whatever you desire.

Two Bulletin Board System programs (BBS's) recently were assigned to me by *the Rainbow* for review. Both require a 64K CoCo with two drives and an auto-answer modem. Both are initialized for use with a Hayes Smartmodem. Our tests were conducted with both Hayes and Bell modems and both worked. There were differences between the two systems, but several similarities. Both are initialized for 300 Baud operation and use machine language drivers for real time I/O. Several utilities are included in the packages for such necessities as making bulletins deleting messages, editing graphics and maintaining a log of users. Electronic mail is the main common feature of both Bulletin Boards. Either can send pictures to the user and have a database of programs for downloading. Both offer help commands for new users and a chat mode for talking to the "SYSOP" (SYStem OPerator) if he or she is available.

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ALSO FROM Aurora Software:

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ROMDISK — If you have a modified 32K C.C. machine ROMDISK will allow you to load your R.S. Rom Packs from a disk! $20.00

Color-80

First let's look at the *Color-80 BBS* by Silicon Rainbow Products, which I would classify as the bells and whistles model. In addition to the standard features, you can choose from editorials, nonsense, rumors, merchandise or even the time and temperature. The menu follows:

<A>pplication
<B>oard Numbers
<C>onfigure
<D>ownload
<E>-mail
<G>oodbye
<H>elp
<L>ogs (users)
<M>erchandise
<N>onsense
<O>pinions
<P>ictures
<R>umors
<S>ysop page
<T>ime & temp
<U>pload
<V>iew system
<?>-help

You can pause or stop any operation by hitting any key repeatedly.

Color-80 has several unique features, the most notable being error trapping. A machine language routine keeps the system from crashing due to improper responses, etc.—very nice! A software clock displays the time continuously on the host computer. It must be calibrated depending on usage of disks and the like.

The user does not have to have a CoCo to access this board, as custom terminal modes are available. An "upload" section is included using *Colorcom* EXON/XOFF format, that is, the BBS sends a character to both open and close the remote buffer. The remote terminal must acknowledge the ">" prompt after every line before transmitting another.

Color-80 is a "private" bulletin board. Each user must "logon" and make application for use of the BBS. The SYSOP then must initialize the user on the system by assigning him a user number by means of a private message. I could not find any reference to the total number of users permitted on the system.

A total of up to 60 messages occupy a semi-circular file and can be killed by the user/originator or the SYSOP. A special menu is available for the SYSOP for remote control of the system.

The source code for machine language is available for an extra charge.

There were some small corrections necessary in the software as this apparently was an early release, but nothing major that would impair operation.

The documentation makes the assumption that everything is going to work fine. It gives a step-by-step method of initialization of the BBS, but lacks a lot when it comes to customization or "what to do if." Customization is very tedious for a new SYSOP. In some cases, the program has to be rewritten to change files such as in downloading. I think

AARDVARK L.T.D.

TRS-80 COLOR COMMODORE 64 VIC-20 SINCLAIR/TIMEX TI99/4A



QUEST – A NEW IDEA IN ADVENTURE GAMES! Different from all the others. Quest is played on a computer generated map of Alesia. Your job is to gather men and supplies by combat, bargaining, exploration of ruins and temples and outright banditry. When your force is strong enough, you attack the Citadel of Moorlock in a life or death battle to the finish. Playable in 2 to 5 hours, this one is different every time. TRS-80 Color, and Sinclair, 13K VIC-20. Extended BASIC required for TRS-80 Color and TI99/A. $14.95 each.

32K TRS 80 COLOR Version $24.95.
Adds a second level with dungeons and more Questing.



WIZARDS TOWER – This is very similar to Quest (see above). We added wizards, magic, dragons, and dungeons to come up with a Quest with a D&D flavor. It requires 16k extended color BASIC. 13k VIC, Commodore 64, TRS-80 16k Extended BASIC, TI99/A extended BASIC. $14.95 Tape, $19.95 Disk.

Authors – Aardvark pays the highest commissions in the industry and gives programs the widest possible advertising coverage. Send a Self Addressed Stamped Envelope for our Authors Information Package.



ZEUS – It's fast and furious as you become the WIZARD fighting off the Thurderbolts of an angry ZEUS. Your Cone of Cold will destroy a thunderbolt and your shield will protect you – for a while. This is the best and highest speed arcade action we have ever done. Difficulty increases in wave after wave, providing hours of challenging fun and a game that you may never completely master. Commodore 64, Vic20 (16k expander), and 16k TRS-80 Color Computer. (ALL MACHINE CODE!)
$19.95 tape $24.95 disk. (Tape will not transfer to disk.)



ADVENTURES!!!

The Adventures below are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer, commands like "Look in the Coffin" and "Light the torch.")

Adventuring requires 16k on Sinclair, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Now available for TI99. Any Commodore 64.
$14.95 Tape – $19.95 Disk.

ESCAPE FROM MARS
(by Rodger Olsen)
This ADVENTURE takes place on the RED PLANET. You'll have to explore a Martian city and deal with possibly hostile aliens to survive this one. A good first adventure.

PYRAMID (by Rodger Olsen)
This is our most challenging ADVENTURE. It is a treasure hunt in a pyramid full of problems. Exciting and tough!



SEAWOLFE – ALL MACHINE CODE in this high speed arcade game, you lay out patterns of torpedoes ahead of the attacking PT boats. Requires Joysticks, at least 13k RAM, and fast reflexes. Lots of Color and Sound. A fun game. Tape or Disk for Vic20, Commodore 64, and TRS-80 Color. NOTE: tape will not transfer to disk!
$19.95 Tape – $24.95 Disk.



Dungeons of Death – This is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character (Human, Dwarf, Soldier, Wizard, etc.), a chance to grow from game to game, and a 15 page manual. 16k Extended TRS-80 Color, 13k VIC, Commodore 64. At the normal price for an Adventure (14.95 tape, $19.95 disk), this is a giveaway.

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improvements could be made in the documentation and the file structure.

CoCo Board II

Lee F. Blitch has refined an earlier program and is now marketing *CoCo Board II*. I would classify this version as the "color" BBS because not only can you download graphics, but several graphic prompts are used during normal operation. Receiving color graphics requires *Colorcom/E*, *Videotex* or an 8-bit receive routine. *Super "Color" Terminal* seems to work fine. Upon entering the BBS, you are given a choice of which terminal software you are using. If you are not using an 8-bit routine, none of the graphics are transmitted.

CoCo Board is a "public" bulletin board in that once you sign on and determine your own five letter password your name is entered into the user log. Up to 102 users are stored in the users log, with the newest user overwriting the oldest if necessary. The first two entries are protected for the SYSOP.

The main menu follows:

<B>ulletin	<C>hat
<D>atabase	<E>nter message
<G>oodbye	<I>nfo
<N>ulls	<Q>uick summary
<R>etrieve messages	<S>ummary
<U>sers log	<?>-help

Messages are organized in a first-in/first-out structure with a maximum of 100. Message format can be private or public. After each <G> command, you are asked if you wish to leave a private message for the SYSOP. This message is recorded on a cassette for retrieval using a supplied utility. Only the SYSOP can kill messages.

A very nice utility is provided for editing graphics. This program is user friendly and provides the SYSOP with a method of customizing prompts, etc., with a combination of graphics and alphanumerics.

Very few problems were encountered using this BBS. The less frills, the less chances of something going wrong. Why didn't Murphy say that?

Again, the documentation needs some work. For a program of this complexity, four pages just isn't enough. At the same time, due to the structure of the programs, additions to the database seem to be easy to implement. An uploading command would be nice.

Summary

Both BBS's are very fun to play with and should fill a void that exists in communication among CoCo users. I would suggest that if you are planning a project for your users' group this would be a fine way to spread the word. It doesn't take long for word of mouth to travel about the new BBS.

The BBS's reviewed provided a dilemma as to which one to use. Each has its strong points. *Color-80* has many more features, but lacks the simplicity of operation of *CoCo Board II*. Maybe someone will combine the two into *Color CoCo Board 82* for the perfect BBS.

(*Color-80*, Silicon Rainbow Products, 663 S. Bernardo Avenue, Suite 225, Sunnyvale, CA 94087, $115. *CoCo Board II*, Lee Blitch, 507 Emory Circle N.E., Atlanta, GA 30307, $110)

—Dan Downard

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Programming The Combat System

By Bill Nolan
Rainbow Contributing Editor

Last month, for those of you who missed my column (heaven forbid!), I talked about some problems with the *RND* function not being reliably random until you fix it up a bit. We also began to lay the groundwork for a computerized combat system to use with fantasy games. If you have not seen the July column you may want to look it over, because we will be continuing on from that point this month.

If you aren't familiar with fantasy games, I want to point out that we aren't talking about computer games. We are talking about the many role playing games available in any toy or game store (*Dungeons and Dragons, Runequest, Tunnels and Trolls,* etc.) These are very complex games, with the rules taking up as much as five books. What we talk about in this column are ways to use the computer to simplify the play of these games as much as possible. The programs presented here are not games themselves, but rather aids to the play of the fantasy games.

It may interest some of you to know that an estimated five million Americans play these games regularly, and a survey done by a large fantasy gaming magazine indicated that enjoyment of computers and fantasy games go hand in hand. Over 90 percent of the fantasy gamers surveyed had a personal computer!

As we indicated in last month's column, the combat systems in these games are an attempt to simulate, by rolling dice, the outcome of a battle between various creatures and humans. To be realistic, a combat system must consider as many of the strengths and weaknesses of the combatants as possible. Because of this, more and more factors are considered. I have seen a battle that would have taken five minutes of actual time require 45 minutes to work through, and that is definitely a job for our friend the computer.

What we are not going to do here is write a program to put an existing combat system on the computer. To start with, the various combat systems are copyrighted by the game publishers, and in addition to that, I think we can do better by designing a system that takes full advantage of the strong points of the computer. So, if you should notice that the combat system isn't the same one you are used to using, give it a chance, anyway. You may well like it better. After all, we can keep track of lots more things on a computer.

First things first. Before we can begin we will need to make a list of things that can affect a combat situation.

1) Weapons—these can be swords, axes, teeth, claws, spears, daggers, etc., and we must consider that some do more damage than others, and some are faster than others to use.
2) Armor—here we must consider both artificial armor such as plate mail and natural armor like dragon scales. Either one makes a telling blow harder to land. In addition to making it harder to land a blow, the armor will also reduce the damage suffered, but almost no existing combat systems take this into account.
3) Strength—this not only will affect damage done, but also will have to be considered with regard to effectiveness of armor.
4) Speed—as any boxer will attest, this can be all important!
5) Multiple attacks—some people fight with a weapon in each hand, and a dragon can bite you, claw you twice and beat you with its wings all at the same time.
6) Skill level—this may be the most important item of all. Some people are expert swordsmen, and then there's me.
7) Initiative—Who has the advantage? Who gets off the first blow? This may be related to speed and surprise.
8) Constitution—How tough are these people or critters, and how much damage does it take to snuff them?
9) Magic spells—these can make weapons and armor work better, or make them work worse, or myriad other effects.
10) Type of person—a magician or thief won't be as good with weapons as a fighter of the same level.

In any combat system, the number one thing to determine is who swings first, so we will have to roll that right away.

(Bill Nolan is a principal in Prickly-Pear Software and teaches "Programming in BASIC*" at Pima College in Tucson, Arizona.)*



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The next thing is to find out whether the blow landed or the arrow found its mark. This is the real heart of any combat system, and before any of the above listed special conditions can be applied, we must have a starting point to work from. This starting point is usually the number that a beginning fighter (just out of basic training?) would have to roll to land a blow.

In our new system we will assume that our neophyte warrior is using a die with 30 sides, and that he (or she) has a 50 percent chance of striking a normal unarmored opponent. In this case then, our sword wielder must roll a 16 or larger to be successful. This is generally called the "base chance," and is changed to reflect the influence of the various factors above. In many systems, damage is calculated by a separate roll of dice, but we are going to base it upon a combination of weapon type and the difference between the roll needed to hit and the actual roll. In fact, we are going to use the same roll to see whose blow struck first.

In order for the computer to be able to take the many modifiers into account, we will have to input the fighting characteristics of the various participants. This can be done before the game even starts, and since there may be a lot of characters and monsters to be considered, we will want to have some way to save a game in progress.

I prefer to write a program in several sections called modules, and then *GOTO* the desired module from a menu of choices. In this program we will need the following modules:

1) *INPUT* section where we enter the data about the combatants.
2) *SAVE* section where we can save our entered data to tape or disk.
3) *LOAD* section to retrieve previously saved data.
4) *EDIT* section where we can examine and change our data as desired.
5) COMBAT section where the actual results of combat are calculated and data updated as necessary.

Those five will be the main portions of the program, and the combat portion will be the longest by far.

By the way, I intend to incorporate full fumble and critical hit tables into the program. If these terms are new to you, a "fumble" happens when a player rolls a 1. This is taken as an indication that something worse than a simple miss has occurred. The warrior may have dropped his weapon, slipped and fallen, broken his weapon or actually hit himself with his own weapon. (Try swinging a mace as hard as you can, and see what happens when you miss completely.) "Critical hits" happen on a roll of 30 in my system and indicate that the blow has been exceptionally effective in some way. It may have done extra damage, severed an extremity or killed the opponent outright. (These games can be bloody at times.)

The basic way the system will work will be like this: Let's suppose I am fighting some evil Knight. I need a base 16 to hit him, but I'm second level, so I need only a 15. Also, I'm exceptionally strong (really?), so I get a bonus of 2 for that. Now I need 13. In addition, my magical sword is +2 to hit and I was recently blessed by a devout cleric (+1 to hit) so I really need only a 10. Unfortunately, my opponent is wearing plate mail, which is 7 armor classes better than no armor at all, so I'm back up to a 17 needed to hit him. He's a better fighter than I am (not hard), and with all adjustments taken into consideration he needs only a 12 to hit me.

When combat starts, I roll a 26 and he rolls a 19. It appears that both blows landed, but in what order? That could be important, because if my blow landed first and killed him, his blow would never land at all. Well, my 26 is 9 higher than I needed to hit him, while his 18 is only 7 higher than he needed to hit me, so my blow landed first. The damage done will be based upon the same thing—the difference between the number needed to hit and the actual roll. Damage will also have to be effected by the weapon used, and each weapon will have a multiplier (usually a number smaller than 1). The difference will be multiplied by the weapon multiplier to determine the damage done.

Since the factors of strength, speed, level, armor of opponent, etc., were used to calculate the chance to hit, they will all play an automatic part in damage calculation. For instance, if my sword were not magical then my number needed to hit would have been two higher and the difference would have been two smaller, thus effecting both the damage done and the determination of whose blow landed first.

To make this system work, we will have to give the computer the following information about each participant in the meelee:

- Name
- Class (fighter, thief, magician, etc.)
- Level
- Weapon(s) used (including magical adjustments)
- Armor type (including magical adjustments)
- Strength adjustments
- Speed adjustments
- Number of attacks
- Hit points (a measure of damage absorbing ability)
- Magic spells currently having an effect

We may well think of other things, but for now let's see a nice method for rolling the dice on the screen. Remember, we want a roll of from 1 to 30.

```
10 CLS:X=RND(-TIMER):P$="T255L255O5AB"
20 PRINT @ 166,"DICE ROLL = "
30 X=RND(30):PRINT @ 178,USING "##";X:PLAY P$
40 IF INKEY$="" THEN GOTO 30
50 PRINT @ 356,"GO AGAIN? (Y/N)":K$=INKEY$
60 K$=INKEY$:IF K$<>"Y" AND K$<>"N" THEN
   60
70 IF K$="Y" THEN 10 ELSE END
```

This little program will give you a rolling number right on the screen, and if you don't want a number from 1 to 30 just change the *RND*(30) in line 30 to *RND*(some other number). Or better yet, add this line.

```
15 PRINT @ 66,"ENTER HIGHEST NUMBER"; :
   INPUT Z
```

Now make the *RND*(30) in line 30 into *RND*(Z). You now have a little program that will simulate the roll of a single die having any number of sides you want it to have!

That's about it for this month. Next month we will have the entire program in the column, along with a section by section commentary and full instructions for use. I hope a lot of you are changing these programs to suit your own needs. With this one, I will try to show you where to change any parameter of the program you find hard to live with. As most of you fantasy gamers already know, these games are very flexible, and almost no two groups play by exactly the same rules. In fact, I know some groups with a notable disregard for any rules at all, but they still enjoy the game.

Remember, if you have suggestions or comments, write to me or call me at Prickly-Pear Software. I can't put what you want into my column unless I hear from you.


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Kid CoCo Is No Lightweight

Little Brother to the Color Computer is not only a tough competitor, but has the ability to grow.

By Dan Downard
Rainbow Technical Editor

Question: What's 8½ x 7 x 2 inches, weighs 29½ ozs. and has Microcolor BASIC for $119.95?

Answer: The MC-10 PoCo CoCo, Radio Shack Cat. No. 26-3011. As you probably noticed in last month's issue of *Rainbow*, Radio Shack has gone after the Sinclair/-Commodore beginners group with its new venture into the Color Computer family. The new unit has color graphics, sound, RS-232, a cassette port, BASIC and 4K of RAM, with provisions to add an additional 16K. No joystick ports are included.

The screen format is the familiar 32 x 16 inch produced by the Motorola 6847 VDG. The most radical departure is in the use of a Motorola 6803 as the MC-10's central processor. Other than the 6803 and memory map, which has radically changed, the MC-10 is essentially a smaller version of the popular CoCo. For those of you who are having trouble finding information on the 6803, try the 6801. The 6803 is actually a 6801 processor running in Mode 2. More on that later.

The MC-10 is one step ahead of the competition in that it has a real keyboard, something that the people at Radio Shack are very proud of, and rightfully so. The keyboard has the same type of keys as the CoCo, although considerably smaller. Keys have dual functions with the use of a "control" key that allows the use of "keywords" or in CoCo terminology, built-in "Master Control."

What about Microcolor BASIC? Immediately after turning on the MC-10 you notice the Microsoft/Tandy logo informing you of the new operating system. Micro-Color BASIC 1.0 is an 8K ROM interpreter that, in a nutshell, is the same as color BASIC with several welcomed additions, such as math functions and a new BASIC command for saving arrays.

Packaging

The shipping package for the MC-10 contains the following:

- The MC-10
- Antenna switch
- Cable from MC-10 to TV set
- Wall plug with in-line power supply
- Operation and Language Reference Manual
- Quick Reference Card

The 133-page reference manual is clear and concise, somewhat in the fashion of all Radio Shack manuals, and the 8½ x 6 inch size is very convenient for bookshelf storage. The Quick Reference Card lives up to its name by providing a summary of all operations and commands.

The MC-10 has a built-in RF modulator and is compatible with any bw/color TV operating on channels 3 or 4. Channels are switch selectable on the bottom of the case. The TV screen was clean and RF free as the modulator has been completely redesigned for this model.

Cassette and Serial I/O connectors are the same as those used for the CoCo for compatibility with existing Radio Shack peripheral devices.

A 34-pin expansion port is centered on the rear of the cabinet for future RAM expansion. Preliminary information indicates a 16K RAM module will be available within 90 days for around $50, upgrading the total user memory to 20K. No ROMpacks are planned at present. Several cassette programs are in the works. Hopefully, one of the first will be a Videotex program for modem communications.

"For those of you interested in energy conservation, the computer draws 16 watts at 120 volts. At today's cost of electricity this means that it costs approximately one-tenth of a cent per hour to operate. Not Bad!"

The power supply is in-line with the AC cord and delivers 8.0 VAC at 1.5 Amps. An On/Off switch on the right hand side of the case actually switches the low voltage AC within the computer. For those of you interested in energy conservation, the computer draws 16 watts at 120 volts. At today's cost of electricity this means that it costs approximately one-tenth of a cent per hour to operate. Not bad!

Microcolor BASIC 1.0

Table 1 contains a complete list of commands available in the BASIC ROM. As you can see it is an impressive list considering the size of the ROM. In addition to the standard

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Table 1
BASIC COMMANDS

BASIC Statements:

CLEARn — Reserves *n* bytes of string storage space (0-3142).
CLOAD - Loads a BASIC program file from cassette. Only the first 8 characters of the file name are used.
*CLOAD** — Loads numeric data into an array from cassette file which has been created using *CSAVE**. Array name must be specified.
CLS(c) — Clears the display to the color (*c*) specified. If *c* is omitted, green is used.
CONT — Continues execution of program after BREAK or STOP.
CSAVE — Stores resident program on cassette tpe. Only the first 8 characters of the file name are used.
*CSAVE** — Saves the contents of a numeric aray on cassette tape for later use by CLOAD*. Array name must be specified.
DATA — Stores data to be accessed by a READ statement.
DIM — Dimensions one or more arrays.
END — Ends program execution.
FOR . . . TO . . . STEP/NEXT — Opens program loop.
GOSUB — Transfers program control to the specified subroutine.
GOTO — Transfers program control to the specified line.
IF . . . THEN — Tests conditional expression.
INPUT — Inputs data from the keyboard.
LIST — Lists program lines to the video display.
LLIST — Lists program lines to the line printer.
LPRINT — Prints an item or list of items on the printer.
NEW — Erases program from memory; initializes all variables.
ON . . . GOSUB — Multi-way branch to specified subroutines.
PRINT — Prints an item or list of items on the display at current cursor position.
PRINT@n — Prints beginning at *n*,*n* = 0-511.
PRINT TAB — Moves the cursor to specified column position.
READ — Reads value(s) from a DATA statement.
REM — Remark; instructs computer to ignore rest of line.
RESET(x,y) — Turns off graphics block at specified location.
RESTORE — Resets data pointer to first item in the first data line.
RETURN — Returns from subroutine to next statement after GOSUB.
RUN — Executes resident program or portion of it.
SET(x,y,c) — Turns on graphics cell to specified color (*c*) at specified locations *x*(horizontal) = 0-63; *y*(vertical) = 0-31. See CLS for colors. If *c* = 0 cell is unchanged or set green (if in character mode.)
SKIPF — Positions cassette tape at end of next file.
SOUND(f,d) — Sounds the frequency (*f* = 1-255) and duration (*d* = 1-255) specified.
STOP — Stops execution of a program.

Functions:

ABS(x) — Computes absolute value.
ASC(str) — Returns ASCII code of first character of string.
CHR$(c) — Returns character for ASCII, control, or graphics code.
COS(numeric) — Returns cosine of an angle given in radians.
EXP(numeric) — Returns natural exponential of number (E^{number}).
INKEY$ — Gets keyboard character if available.
INT(x) — Returns largest whole number not greater than *x*.
LEFT$(str,c) — Returns left portion of string.
LEN(str) — Returns the number of characters in a string.
LOG(numeric) — Returns natural logarithm.
MEM — Finds amount of free memory.
MID$(string,pos,len) — Returns a substring of another string. If length option is omitted, the entire string right of *pos* is returned.
PEEK(n) — Gets value in location *n*(*n* = 0 to end of memory).
POINT(x,y) — Tests whether specified graphics cell is on or off, *x* (horizontal) = 0 - 63; *y* (vertical) = 0 - 31. The value returned is - 1 if the cell is in the character mode, 0 if it is off, or the color code if it is on. See CLS for color codes.
RIGHT$(str,c) — Returns right portion of string.
RND(n) — Generates a "random" number between 1 and *n* if *n* > 1, or between 0 and 1 if *n* = 0.
SGN(x) — Returns sign component: - 1,0,1, if *x* is negative, zero, positive.
SIN(x) — Computes sine; angle must be in radians.
STR$(x) — Converts a numeric expression to a string.
SQR(numeric) — Returns the square root of a number.
TAN(numeric) — Returns tangent of angle given in radians.
VAL(str) — Evaluates a string as a number.

BASIC commands of Color BASIC we are treated to the math functions of *COS, TAN, EXP* and *LOG*. I think these are valuable additions, especially for educational use. Two new commands are implemented:

*CLOAD** Loads numeric data into an arrary from a cassette file which has been created using a *CSAVE** statement.
Example: *CLOAD*A,DATAFILE*
*CSAVE** Saves contents of a numeric array on cassette for later use by *CLOAD**.
Example: *CSAVE*A,DATAFILE*

Since all cassette file information is handled through the above commands, gone are the tedious *OPEN, CLOSE* and *FOF* commands encountered by every beginning programmer. I wish we could add these commands to Extended Color BASIC.

There are no commands for executing machine language programs such as *EXEC* or *USR*. Machine language programs are apparently not supported in Microcolor BASIC 1.0. The 6803 command set is a subset of the 6809 instructions; therefore, machine language programs should not be entirely compatible anyway, but the 6803 is upward compatible with the 6800 and I'm sure a method will be devised for ML program execution.

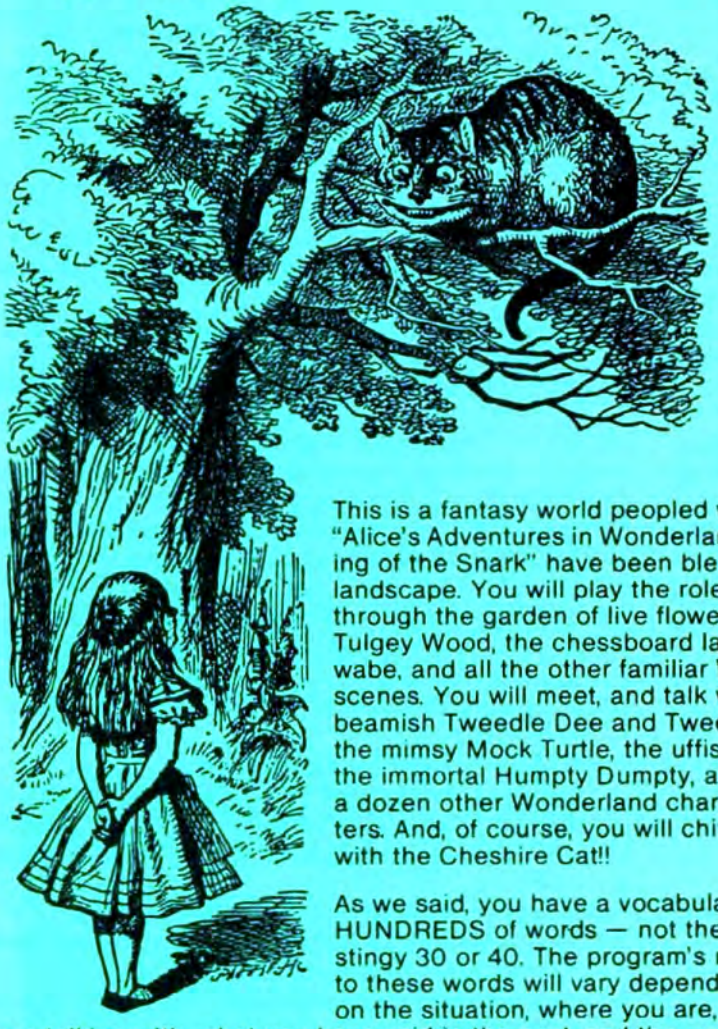
Pressing the Control key along with another key enables designated keywords, or BASIC commands, to be input with only two keystrokes. Graphics characters can be generated by a combination of the Shift and certain alphanumeric keys. The keyboard has a few editing commands built in such as full cursor control and line delete. Figure 1 shows a



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As we said, you have a vocabulary of HUNDREDS of words — not the usual stingy 30 or 40. The program's response to these words will vary depending on the situation, where you are, who you are talking with, what you have said in the past, and the way in which the words are combined. Your task is to become Queen, save Wonderland from the Snark, and manage to return home. You may feel completely trapped in certain places in Wonderland, but there is always a way out . . . in fact, there are always (at least) three exits from each trap. An open mind, a pure heart, and a touch of Wonderland madness will keep you from despair!!

This is not an easy adventure, and will provide ample challenge for the most experienced adult players, but you will have so much fun conversing with the denisons of Wonderland that you may not want to leave anyway. We want to repeat what we said above, because we really mean it. WE BELIEVE THIS TO BE THE VERY BEST ADVENTURE EVER WRITTEN FOR THE COLOR COMPUTER. After you have tried it, you'll think so too! 100% machine language — Fully 32K long. **Tape - $24.95; Disk - $29.95**

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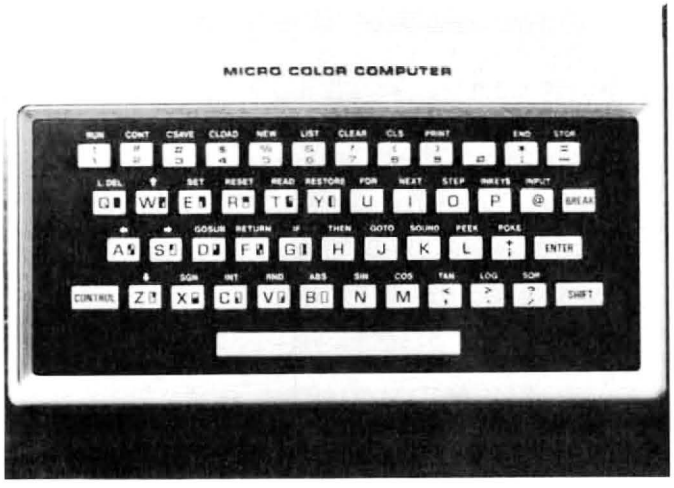
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picture of the keyboard. The only inconvenience was the location of the Control key. I hit it several times mistaking it for the Shift key. After a little use this does not seem to be a major problem.

Microcolor BASIC 1.0 supports two modes of operation, a green background 32 x 16 inch alphanumeric display mode, and a 64 x 32 inch resolution 8-color graphics mode (Semi-graphics 4). Other modes are programmable by *POKE* statements but are limited to *SET/RESET* commands for pixel control. A *POINT* command is available to examine the state of a particular graphic element.

Figure 1
KEYBOARD PHOTO



Cassette Interface

A 1500 Baud cassette interface with a standard 5-pin DIN plug is on the left rear of the case. Cassette format is similar to the CoCo with one notable exception. BASIC tokens are different in Microcolor BASIC. This means that tape programs from a CoCo will load but will not execute. This is not as serious as it sounds. First, most BASIC programs written for the CoCo will execute on the PoCo (MC-10). You will initially have to type them in manually. At the same time, we will leave it to our readers to come up with a scheme of converting BASIC tokens to a PoCo format. After conversion I would see no reason why tapes for the PoCo could not be generated by a CoCo.

No cassette relay is included in the interface. Starting and stopping of the recorder must be done manually.

RS-232 Interface

Also, on the left rear of the case is a 4-pin DIN plug for connection of an RS-232 serial printer or modem. The format is fixed at 600 Baud, 7 bit, no parity and, as in other Radio Shack devices, assumes that the printer generates a line feed after carriage return. Software reverts to the Model I format by the use of *LPRINT* for all output to this port. No mention is made of how to input data from this port in the documentation. At the same time, those readers familiar with the 6803 will remember that the processor has built-in serial I/O and this data can be examined using one of the external registers. More on that in a minute.

External Cartridge Port

A 34-pin PC board connector is available on the rear of the case for future expansion. At present the only expansion in the works is a 16K RAM catridge. For those readers with different ideas the pinouts of this connector are given in Table 2. As you can see, all of the necessary bus information is present for most peripheral interfaces and memory expansion. As we mentioned earlier, it seems that Radio Shack has opted to go with a cassette-based system leaving the ROM option for the CoCo user.

Table 2
Expansion Connector

Pin 1—Ground	Pin 2—Ground
Pin 3—D0	Pin 4—D1
Pin 5—D2	Pin 6—D3
Pin 7—D4	Pin 8—D5
Pin 9—D6	Pin 10—D7
Pin 11—Read/Write	Pin 12—A0
Pin 13—A1	Pin 14—A2
Pin 15—A3	Pin 16—A4
Pin 17—A5	Pin 18—A6
Pin 19—A7	Pin 20—A8
Pin 21—A9	Pin 22—A10
Pin 23—A11	Pin 24—A12
Pin 25—A13	Pin 26—A14
Pin 27—A15	Pin 28—E/Clock
Pin 29—Cart Select	Pin 30—Reset
Pin 31—NMI	Pin 32—+5V
Pin 33—Ground	Pin 34—Ground

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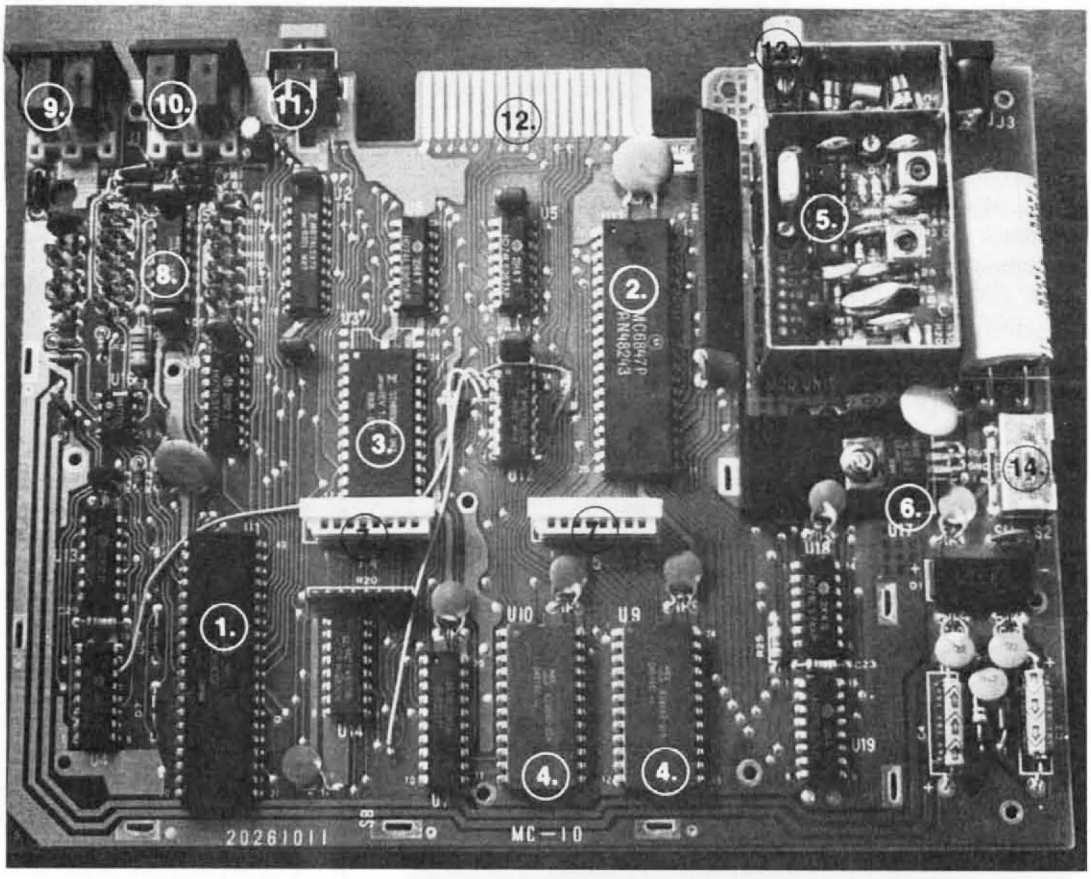
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Figure 2
CIRCUIT BOARD



1. Microprocessor
2. Video Display Generator (VDG)
3. Read Only Memory (ROM)
4. Random Access Memory (RAM)
5. R.F. Section
6. Power Supply
7. Keyboard Plugs
8. RS-232 and Cassette
9. Cassette Plug
10. Serial I/O Plug
11. Reset Button
12. Expansion Connector
13. T.V. Connector
14. On/Off Switch

Hardware

Figure 2 shows the inside top view of the circuit board with the keyboard and RF shield removed. As you can see, the unit is very compact and of a no frills variety when it comes to design. The main components are identified in the photo and can be subdivided as follows: Microprocessor, ROM, RAM, VDG, RF Modulator, Serial and Cassette I/O and Address Select hardware.

Microprocessor

A 6803 microprocessor is the heart of the MC-10. The 6803 is a 6801 without internal ROM running in Mode 2. Mode 2 is the Motorola terminology for the configuration of memory and ports. The 6803 contains 128 bytes of on-chip RAM, a built-in serial I/O and programmable timer. The processor has 21 internal control registers, of which four are not used and four are unavailable for use. Two of the internal registers are used to make a 16-bit counter/timer that is incremented during each clock cycle. The clock is derived from a 3.57 MHz color burst crystal that is part of the VDG/RF circuit. The actual clock speed of the processor is 3.57/4 or .895 MHz.

Port 1 (pins 13-20) becomes the column strobe for the keyboard. Port 4 (pins 22-29) becomes the upper eight bits of the address (A8-A15). Port 3 (pins 30-39) in combination with a 74LS373 Latch provides the lower address and data lines along with the read/write signal.

Port 2 (pins 8-12) is multifunctional. Bit 1 is the RS-232/Cassette output signal. Bit 2 is another column strobe for the keyboard dedicated to the Shift/Break/Control keys. Bit 3 is the RS-232 input signal. Bit 4 is the Carrier Detect (CD) input from the RS-232 port. Bit 5 is the cassette input.

Without going into great detail on each of the 6803 registers we might mention a few that will be of great interest to the hobbyist. The Rate and Mode Control Register is located at $10, the Serial Rx Data Register is located at $12 and the Serial Tx Data Register is located at $13. For the 6803 these registers are memory mapped and can be examined by the user. Bits 0 and 1 of the RMCR control the baud rate of the serial I/O. By reading and writing to the Serial RxTx Registers we can input and output data to the RS-232 port. In all, these registers occupy locations $00-$15 of the memory map.

ROM and RAM

Microcolor BASIC 1.0 is provided by means of an 8K x 8 ROM. The identification on ours was 8364. Two D4016D RAM chips provide 4K on-board user memory that has to be shared with the display and BASIC housekeeping. Ceramic memory chips were used throughout. All memory chips and the microprocessor are shielded by means of a metal cover that is soldered to the main circuit board.

VDG/RF Modulator

As in the CoCo the screen output is determined by a 6847 Video Display Generator (VDG) chip driving a 1372 RF Modulator. No SAM chip is included for memory management. Memory contention between the VDG and CPU is handled by a clock synchronization circuit along with some discrete chips. Two 74LS367 and a 74LS245 IC provide bus isolation for writing to the video display. Although used as a video mixer in the CoCo, the 1372 also contains a complete video RF modulator section which is used in the MC-10. A varactor-tuned FM oscillator produces a sound carrier.

As previously mentioned, only the Alphanumeric Internal and Semigraphics 4 Modes are supported by Microcolor BASIC 1. For those of you who care to experiment with different graphic resolution modes Table 3 contains the connections of the control pins on the 6847 VDG along with the sound output bit located at 32768 on the memory map. A POKE32768,XX will bring interesting results.

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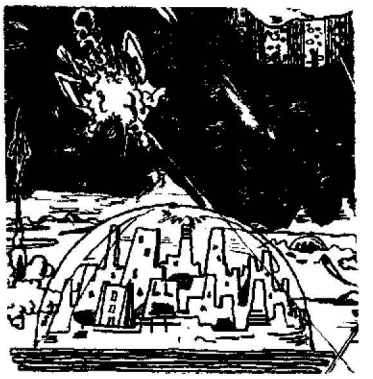
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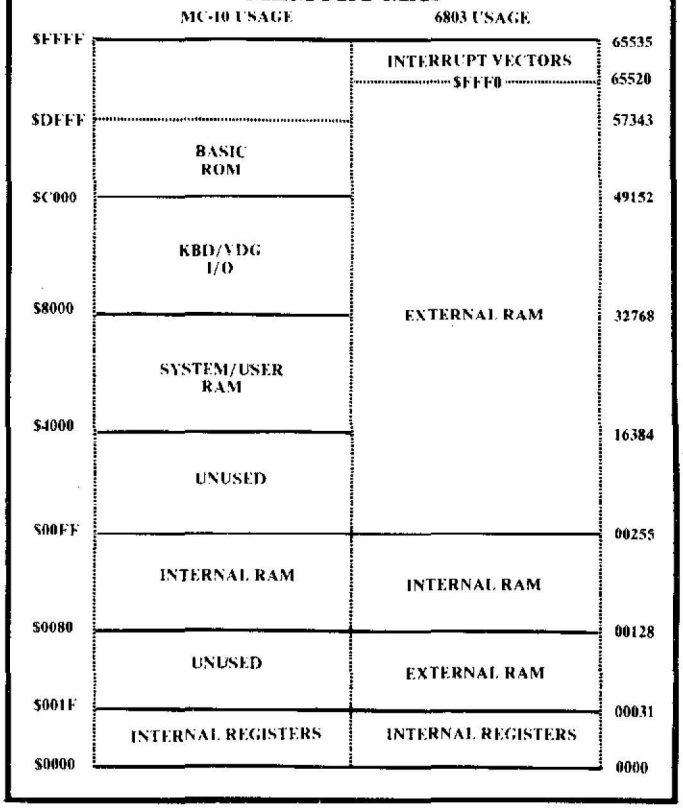
Table 3
VDG PORT

Address: $8000
Bit 2—VDG EXT and GM2
Bit 3—VDG GM1
Bit 4—BDG GM0
Bit 5—VDG A/G
Bit 6—VDG INV
Bit 7—Sound

Memory Map

Figure 3 shows a coarse memory map of the PoCo. Only a few comments are necessary. The screen display memory begins at $4000(16384) and continues to $41FF. All 6803 vectors occupy the addresses from $4200 to $4212 and contain RTI instructions. BASIC program space immediately follows. The BASIC restart vector points to $F72E so if you want to try a disassembly, this would be a good place to start.

Figure 3
MEMORY MAP



Summary

Radio Shack has obviously put their resources to the task to compete in the low priced market and, as far as we can see, they have risen to the challenge. Hopefully, by a favorable initiation into the world of microprocessors for a reasonable price, Tandy will introduce the user to its fine line of advanced products and peripherals. I would recommend this model to any beginning user for one reason. I predict that software will be abundant due to the similarity and family ties to the Color Computer. Where else can you buy a computer with a real keyboard, cassette and RS-232 ports and color graphics for $119.95?

STAR—KIBBITS

I'd like to thank all of you who stopped by our booth at the Color Computer show in Chicago in April. I certainly enjoyed meeting so many old friends and new customers, and had a delightful time. We even managed to liven up the last day of the show by raffling away a TV set and holding a Dutch auction. Sure hope there's another show soon!

If you have a disk system, I'd like to urge you to use the verify option. Before saving to the disk, type VERIFY ON (or include it in a program). After the disk system writes to the disk it reads the data back to make sure it was written properly. While this really slows everything down, it's a worthwhile precaution to help guard against loss of programs or data. (Quite common in other systems, too.)

Several customers have asked about our update policy. It's fairly simple: within 90 days of purchase, an update is free — just return the original disk or cassette. After 90 days an update costs $10 (to make things interesting, we will also accept one pre-1965 silver dollar.)

We also have a liberal policy on software upgrades. If you now own HUMBUG or STAR-DOS, we will give you full credit toward the 64K versions. That means that 64K HUMBUG will cost you just $20 more, while 64K STAR-DOS will cost you just $25 more.

What, you say, is so special about the 64K versions? Quite a bit. STAR-DOS 64, for example, provides upper and lower case display with 40, 51, or 64 characters per line; it can be used with 35-, 40- or 80-track drives, single-or double density, single- or double-sided. But, aside from the fact that it provides a simple, straightforward interface to the disk, a very interesting aspect is its compatibility with other 6809 operating systems. For example, many programs written for FLEX™ (a trademark of Technical Systems Consultants Inc.) will also work with STAR-DOS 64. We are using TSC's text editor and macro assember with STAR-DOS right now. They work just fine, but the big difference is that their disk format is compatible with other software for the Radio Shack disk system.

As to 64K HUMBUG, that's an intersting story too. This HUMBUG runs as a utility under either STAR-DOS 64 or Flex (that's right, the same HUMBUG runs with either — it even runs on bigger systems using Flex.) That makes HUMBUG unique — it is the only monitor that runs under Color Computer Flex. HUMBUG provides all the facilities that are needed for machine and assembly language programming and debugging in a 64K environment. You can start and stop programs, insert breakpoints, even single-step through programs. There is just no other way to do these things in a 64K Color Computer!

One of the problems with a monthly column is keeping up with publishing deadlines. As you probably noticed last month, I have already fallen behind. But at least there is one consolation — the sooner you fall behind, the more time you have to catch up. See you next month.

SPELL 'N FIX

Regardless of whose text processor you use, let SPELL 'N FIX find and fix your spelling and typing mistakes. It reads text faster than you can, and spots and corrects errors even experienced proofreaders miss. It is compatible with all Color Computer text processors. $69.29 in the Radio Shack disk or cassette versions; $89.29 in the Flex version. (20,000 word dictionary is standard; optional 75,000 word Super Dictionary costs $50 additional.)

HUMBUG — THE SUPER MONITOR

A complete monitor and debugging system which lets you input programs and data into memory, list memory contents, insert multiple breakpoints, single-step, test, checksum, and compare memory contents, find data in memory, start and stop programs, upload and download, save to tape, connect the Color Computer to a terminal, printer, or remote computer, and more. HUMBUG on disk or cassette costs just $39.95, special 64K version for FLEX or STAR-DOS 64 costs $59.95

STAR—DOS

A Disk Operating System specially designed for the Color Computer, STAR-DOS is fully compatible with your present Color Computer disk format — it reads disks written by Extended Disk Basic and vice versa. STAR-DOS for 16K or 32K systems costs $49.90; STAR-DOS 64 for 64K systems costs $74.90.

STAR FLEX

The best implementation of FLEX for the Color Computer. Complete with all utilities, text editor, macro assembler, and HUMBUG debug monitor, $250.00.

ALL IN ONE — Editor Etc.

Three programs in one — a full function Editor, a Text Processor and a Mailing List/Label program. All this for just $50. Requires STAR-DOS and 32K, or STAR-DOS 64, or FLEX, specify which.

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This ML Adventure Can *CSAVE* Your Life

I've been wandering these passages for hours now. There are three exits here: North, South and West. Northward, then! Hurrah, here is the Oracle that was foretold. O great Oracle what may you tell me of this accursed labyrinth? The old one calls out, "The secret to the Light ring is the Power ring, Crom and the Tailsman!," and with a flash of light he is gone. So, the pendant is one of the Keys, but what is Crom and where is the Power ring? The walls are shaking! What trick of the dark lords is this! Zeus' beard! It's a cave-in. My last thoughts are regret and pain as a great block of granite crashes down.

A horrible death, but *don't worry,* in Radio Shack's adventure *Madness and the Minotaur* your alter ego is easily reincarnated, *if* you have saved the data for this particular set-up that is. If not, you can always start a completely fresh game.

This is a machine language adventure that is different *every* time it is started from scratch. Solving most adventures requires several attempts before completion and this one is no different. So, what do you do when every game is different? Just use the game save feature included at the beginning (just in case you meet a quick death) and, then later, if you are still alive and doing pretty good, make another save from that point. Saves take very little tape space and don't take much time. Starting again is simply a matter of loading in the program and then the data and you're right where you left off.

Another nice feature of this game is the QUIET command which allows you to pause a game in progress and come back later as long as your CoCo is on (excellent for "pit stops," snack breaks or when the wife threatens to beat you severely if you don't give her some attention). This feature is also good for another important aspect of the game, even though I don't think the programmer(s) intended it, and that is map making. In this game, if you sit still for very long at all, the walls start shaking, followed very shortly by a cave-in. So to facilitate mapping, I type QUIET as soon as I enter a new room and note any features of interest and exit directions. This is especially important when starting a fresh game because, even though there is a core of rooms that don't change, there are portions that are randomized along with the other variables. QUIET is also the mode from which the saves and loads are done.

Motion commands are single letter (U, D, N, S, etc.) and other commands are generally two-word in the familiar verb/noun format. One exception to this is the BACK command which is used if you enter a room with exits that are already blocked . . . *if* you are quick! Another appreciated feature is the SCORE command (also done automatically on death or completion) which lets you know how well you are doing as you go along. It can also help you determine if the objects you find are really treasures or not. By the way, I tried using AD-DICT (*Rainbow,* February, 1983) on this game and only got a little help since quite a bit of info seems to be in non-ASCII format, possibly due to the "randomness." But, there are a few tidbits of interest.

The documentation is the familiar Radio Shack booklet, eight pages in length, three of which have to do with actual game playing (scoring, spells, a FEW hints, etc.). The rest of the booklet more than adequately describes the features I have mentioned and a few more. If the name of this program sounds familiar, a look at the copyright page will show you that this is the same game from Spectral Associates, only now it's under license to Tandy Corporation.

The "random" feature has its pluses and minuses. The number of things randomized can lead to some games that are almost unbeatable and some that are relatively easy (darn few!). But, it keeps this from being a "solve-it-and-put-it-away" type adventure if you don't mind the data saves.

All in all, I give it a hearty recommendation, especially for the price.

(Radio Shack, nationwide, Cat. No. 26-3313, $14.95 on tape)

—Bruce E. Sterling

QUASAR

ANIMATIONS

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MONEY MINDER II is the cassette version of DISK MONEY MINDER. Reviewed in April 1982 Rainbow and improved since then!
Requires 16K but does NOT require Extended Basic **$14.95**

PIE-CHART is a unique graphing program. It allows you to enter data such as monthly bills, yearly expenditures, etc. This data may be entered as percentages or in its "raw" state. Data entered raw will be converted to percentages by the program. The resulting PIE-CHART can be saved to tape or the data itself can be saved to tape for later use. By using a screen print program (not supplied) you can make printouts of the pie-charts. One unique feature of the program allows you to save a large number of pie-charts or other hi-resolution screens to tape and reload and display them one at a time by "flipping" through them quickly much as you might do with a slide show presentation. This feature would be great for a sales presentation, club meeting or retail display. Other features—automatic screen writing i.e. designations—up to 20 entries possible per pie-chart—keyboard toggle of "raw" vs percentage data entry.
PIE-CHART needs 16K and Extended Basic **$10.95**

AMORT asks you to input the amount of a loan, the term of the loan and it's interest rate. The program will print to screen and/or to your printer and will give you: 1—a running total of principal still to be paid. 2—The amount of the monthly payment applied to principal. 3—The amount of the monthly payment applied to interest. 4—The total monthly payment. 5—The total amount paid into principal to date. 6—The total amount paid into interest to date. 7—The total amount payed out to date.
Requires 16K and Extended Basic **$11.95**

COLORHYTHM is a biorhythm program for your Color Computer. It plots in High-Resolution graphics (PMODE3) and color a 15 day biorhythm chart displaying your Intellectual, Emotional & Physical biorhythms. Reviewed in August 1982 Rainbow.
Requires 16K & Extended Basic **$9.95**

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MATCH & SPELL combines a game similar to the familiar TV game of CONCENTRATION and a spelling drill to provide a truely unique and fun program. You may load a spelling list (up to 32 words of up to 11 letters each) from tape or keyboard. The program then allows you to study the list for as long as you like. After that the game begins. One of your words is presented to you either correctly or misspelled with a common spelling error. You are asked if it is spelled right. Then the correctly spelled word is displayed for a brief time and you are then asked to spell the word. The CONCENTRATION type game is played by one or two players during the spelling drill.
A lot of fun for 16K and Extended Basic **$11.95**

PRESCHOOL PAK consists of two programs for preschooler learning fun. ALPHABET drills the child in alphabet recognition and rewards a correct answer. COUNTER drill the child in counting to 10. Both use Hi-Resolution graphics and sound. Reviewed in September 1982 Rainbow **$8.95**

MATHWAR is an educational game. In the game the player must jump one space-fighter over another checkers style, until only one fighter remains. Each time a move is selected the program will not complete the move until a math problem is answered correctly. The player selects addition or subtraction and one of four difficulty levels. Level 1 is problems with numbers up to 19 but no carrying or borrowing is required. Level 2 is the same as Level 1 but numbers up to 99 are allowed. Level 3 uses numbers up to 19 but allows carrying and borrowing problems. Level 4 is the same as Level 3 with numbers up to 99. No negative responses to wrong answers and the math score is displayed at the end of the game.
Requires 16K and Extended Basic **$11.95**



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Software Review

Desert Golf: Good Graphics But Still A Bogey

When I received this game in the mail I quickly opened it, eagerly anticipating a fun game of computer golf. I have seen some of Spectral's other game such as *Ghost Gobbler* and *Planet Invasion* and was quite impressed by their quality. Besides, it was a cold day and I would much rather spend it inside than on the links.

The documentation is brief but adequate. The premises of the game is that it is the final round of a major golf tournament and you are among the leaders with nine holes left to play. Text screen displays are used to show available clubs, standings (leader board), and review of scores (your scorecard). A text screen is also used to display your current status including length of hole, distance to green, distance of shot, and a menu to get you to the above mentioned screens and two graphic views of the hole. All the text screens are nicely formatted and include some color graphic block borders. The two graphic screens are done in PMODE 3 to make use of four colors. One shows an overhead view of the hold and the other shows a view from the tee and even includes the mountains in the background. These graphics are extremely well done.

At this point I was ready to play the game and it was here that a severe case of disappointment set in. The graphics are not used for the play of the game. It is a text type game that could be played all the way through without ever looking at those beautiful graphics! To play, you select a club and enter. You can then sit and watch the distance from hole counter run down while the length of shot counter runs up. A request to display the overhead view of the hole shows the same screen we saw at the start. Ball position is not shown. Club selection is also a disappointment—you get three woods, the 3, 5, 7, and 9 irons, and SW. They are not good for the same distances a standard club would be. I learned this when I selected a seven iron for a 130 yard shot. A message displayed "solid hit" and the distance counter ticked off 45 yards—certainly not a "solid hit" for someone in a major tournament. When I finally made it to the green, putting was as unexciting as the rest of the play. You are shown the distance from the cup in text and asked to pick a putting strength of 1-15. I quickly learned that a strength of from one-half to one-third of the distance to the hole usually resulted in sinking the putt.

Another disadvantage of this game is that it always plays the same nine holes. I'm sure the reason for this is the excellent graphics; it would be almost impossible to randomize the holes and still maintain the same quality within 32K. Finally, this is a one-player game. You can't invite the boys over on a snowy evening to enjoy a round of indoor gold.

I also have the Tom Mix game which *does* use the graphics to show the play of the game and, although the Spectral game has superior graphics, the Tom Mix game is definitely more fun to play.

Desert Golf requires 32K and Extended BASIC.
(Spectral Associates, 141 Harvard Avenue, Tacoma, WA 98466, $8.95)

—James G. Kriz



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SPECIAL — CLOSEOUT of Creative Computing's never released software for the CoCo. 2 Hi-Res machine language, joystick controlled arcade style games. PICNIC (escape spider, capture food). TRICKASHAY (tank duel in a tricky maze). 1 or 2 players, multi-level. 16K Ext. Both for an incredible $11.95

Software Review

Refreshing *Trapfall* Requires Quick Thinking, Luck

Mention the words jungle survival to any soldier and his face will usually register a considerable amount of distaste. But now, thanks to Tom Mix Software and Ken Kalish, you can feverishly work your way through a tough jungle survival course without ever leaving the comfort of your computer room.

This program is similar in name and appearance to a popular arcade game. You must maneuver your man over the course running from screen to screen and avoiding obstacles and dangers. The right joystick controls direction and pressing the fire button makes your man jump. The obstacles include pits into which you can fall, rolling logs, ponds full of alligators, quicksand pits which appear and disappear, snakes and, just to keep things nice and creepy, scorpions in the underground caverns.

There's even the odd native campfire, its flames still flickering. (Wonder what they've been cooking?!) Some of the screens require you to jump to catch a swinging vine in order to cross a hazard and, believe me, jumping at just the right time is no small feat. It's particularly interesting when you hit a stretch of three or so of these screens in a row. If you time it just right, you get the feeling of swinging from vine to vine.

The action is fast and furious and there is little time to stop and catch your breath. Thankfully, our little "Indiana Jones" never seems to get tired. He continues to run fast and jump high no matter how breathless the player gets.

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87112

Colors and animation are very good and control is responsive. Scoring in *Trapfall* is a little different; you begin the game with 2,000 points and a time allotment of 20 minutes to find as many treasures as you can. Being hit by any of the rolling logs or falling into any of the pits costs you points only. Sinking into quicksand, being eaten by alligators, being bitten by a snake or being stung by a scorpion costs you a man, of which you have three. The only way to score points is to find the treasures. My high score to date is 27,300 points in a game in which I found five or six treasures.

On screen scoring, display of the highest score in the current session and number of men remaining are provided, as well as a digital clock which counts down your time remaining. I haven't as yet survived long enough to run out of time, but I imagine things could get a little crazy if you were trying to find one last treasure before time runs out. The sound effects are good and do not slow down play at all.

Documentation is only enough to get you started; it's up to you to enter the jungle and discover its secrets on your own—which, after all, is the way it should be.

One other thing about this program I like is that it is entirely controllable with the joystick. After your last man has sunk out of sight in a mire of quicksand, all you have to do is press the fire button and you are at the title screen; press it again and you are off on a new game. This lets you sit back in your favorite armchair and play game after game without ever having to lean forward to press any keys after each game. (Okay, so I'm a little lazy.)

Trapfall requires 16K and is written in machine language. On a 16K machine you must do a *CLEAR* 8 in command mode before loading the program, but this isn't necessary with 32K.

I enjoy this game; it demands quick thinking and fast reaction time. A little luck comes in handy also. The graphics are very good and *Trapfall* is a refreshing change from space games. I think it would be a great addition to any game library. This one is a must.

(Tom Mix Software, 3424 College N.E., Grand Rapids, MI 49505, $27.95 tape and $30.95 disk)

—David Johnson

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Dear Kids,

Last Thursday morning, I heard a terrific commotion underneath the front porch—a howling and snorting and scruffling around like you couldn't imagine. I crawled under there, and lit a match. What do you think I saw? Dust every which way, and dirt flying around. Ben's two hind legs flapping backwards and his tail whipping back and forth like crazy. I grabbed one of his legs and pulled backwards until we both fell back into a bunch of legs and ears. Clamped at the end of Ben's nose was a turtle. I pried the turtle loose, Ben ran into the woods, and I took the poor creature inside the house.

I had been thinking about turtle graphics, so I thought I'd try it out for real. I spread a big sheet of paper on the floor, tied a pen to the turtle, and let him loose. He struggled along for a while in a straight line, and drew a straight line behind him. Then I changed his direction, and he drew another straight line. I changed his direction again, and he drew a third straight line. I was hoping for a triangle, but got something else. I put a new sheet of paper down, tried again, but still no triangle. I put down a third sheet of paper, and tried again with a little better luck. Well, that was entertaining, but I realized why some of these people have been putting turtles onto computers: a turtle without numbers won't get you very far. Also, real turtles really are slow.

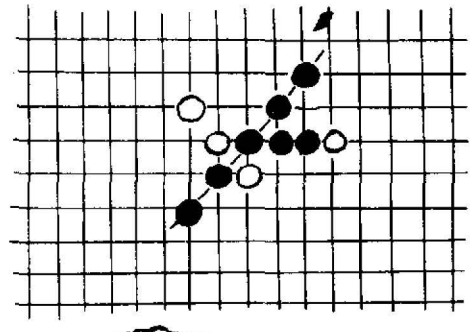
I went down to my Color Computer in the den, and thought I would try triangles on that. I got the thing going, pressed "R" which put me into the turtle's "run" room. Next, I tried to reproduce what I had done with the turtle. First I ran this (pressing *ENTER* after every line):

```
FD 40
RT 90
FD 40
RT 90
FD 40
```

Next I ran this (having CLEAR'd the screen):

```
FD 40
RT 80
FD 40
RT 190
FD 40
```

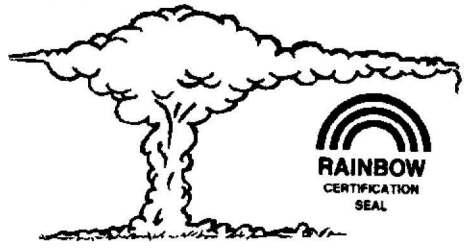

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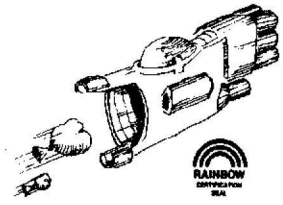
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****

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Finally, I ran this:

```
FD 40
RT 130
FD 40
RT 130
FD 40
```

That last one was a triangle of sorts, although those extra legs sticking out bothered me a little. I smoked my pipe and thought that things might be easier to figure if I just tried very carefully to make the simplest possible triangle: a triangle with three equal sides and three equal angles.

Next, I thought this: "I've only been giving instructions for two of the three angles, because the third is automatically formed. But if I'm trying to draw a triangle of three equal sides and three equal angles, I ought to define that third angle—and then check out my guess by having the turtle draw out an extra line from the third angle."

I tried the following:

```
FD 60
RT 110
FD 60
RT 110
FD 60
```

It wasn't a triangle. "What do I learn from adding one more angle and an extra, double-checking side?" I asked myself.

```
RT 110
FD 60
```

That fourth side that I just added should really be tracing over the first side—if I had really drawn the triangle properly. Now it comes to me! Eureka! I know already that a complete turn of the turtle is a 360-place, or position or degree, turn. If that fourth side is supposed to be tracing the first side, that means that by the time we get to that fourth side, the turtle should have already gone in a 360 degree turn. That means that, if the turtle is going to be making a total of three turns (in a three-angled, or three-turned figure), the three turns should add up to 360—otherwise that extra checking-up line won't overlap the first side. Let me try using three turns worth 120 each and see what happens:

```
FD 60
RT 120
FD 60
RT 120
FD 60
RT 120
```

That looks pretty good. Add the overlapping side just to check (add another FD 60), and presto! It works. A quick examination shows that this works no matter what the size of the sides are—so long as I keep them equal in length.

Well, that all makes sense. I already know that in order for the turtle to spin around once and return to its original position I have to tell it to spin 360 units of spin (or degrees), that is, to "RT 360" or "LT 360." Maybe any closed figure of any number of angles and sides would have to give me a total of 360 degrees of turn. (Note: My spies tell me that this will only be true of closed convex geometric figures—in other words, as long as every time the turtle turns to make an angle, it turns in the same direction, instead of meandering this way and that all over the place.) That makes sense, too.

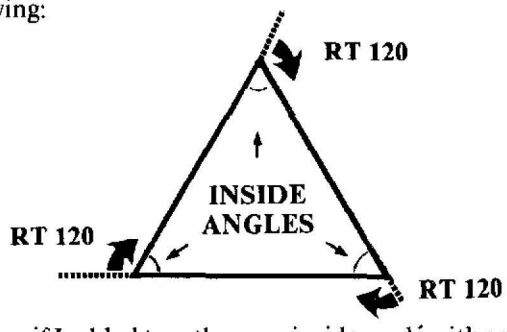
To test out my idea, I try a four-sided (equal-angled, equal-sided) figure. First, to find the degrees of turn, I divide 360 by 4. That gives me 90. Then I choose sides of equal length.

```
FD 50
LT 90
FD 50
LT 90
FD 50
LT 90
FD 50
```

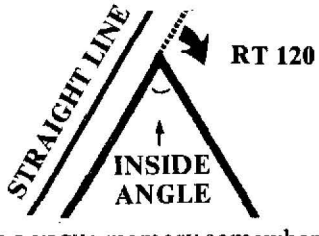
I add an extra "LT 90" and "FD 60" just to check everything, and indeed it does work out. Next, I take the same principle, and move onto more challenging territory. I try a ten-angled, ten-sided figure—and start by figuring maybe the degrees of turn should each be 360/10, or 36 each. Yes indeed, it works (and works easily, if the sides are of equal length).

I'm sure this all is old hat to most, maybe all of you—especially you, Tad and Andrew!—but you have to remember that when I was in school it was a long time ago, and I slept a lot. Anyhow, I was so proud of myself for figuring these things out, I made the mistake of showing Bertha. She's been speaking to me lately. "That's nice, but what are your angles?" she asked. "Angles?" I asked back. "The inside angles of your figures," she said. Having crushed my self-confidence, she waddled away.

Back to the drawing board. I couldn't stretch my turtle thinking any further right then, so I took out a pencil and paper, and drew a equal-sided, equal-angled triangle. Next, I thought about how my turtle was moving and what my instructions for turning really meant. I came up with the following:



Now, if I added together one inside angle with an angle of "turtle turn," it came out to a total angle that was really like a straight line.



I seemed to have a vague memory somewhere near the back of my head that an angle opening into a straight line was represented by 180 degrees. I tried it out with the turtle, and sure enough, 180 degrees made a straight line. That meant, it seemed to me, that each of my inside angles on this triangle would be 180 minus 120, or 60 degrees. Adding all three inside angles together gave me a total of 180 degrees.

I tried the same with a square. I figured out the inside angles for a square and found them to be 90 degrees each, for a total of 360. I tried the inside angles for a pentagon, and found them to be 108 each, for a total of 540. I tried the inside angles for the "ten-agon," found them to be 144 each, for a total of 1440. To be truthful, that was about as interesting as a dandelion to me. I couldn't really figure out any particular meaning or pattern to that. I thought it was neat that, whenever I wanted to draw a closed geometrical figure, all I had to do was make sure the total turtle turns added up to 360. But I didn't see that adding up the inside angles told me much of anything. (Note: My spies tell me that Mr. Rick Billstein has a nice article in the November 1982 issue of *The Computing Teacher* on how the turtle can be used to do such things, and also to prove a special formula for figuring out sums of inside angles.)

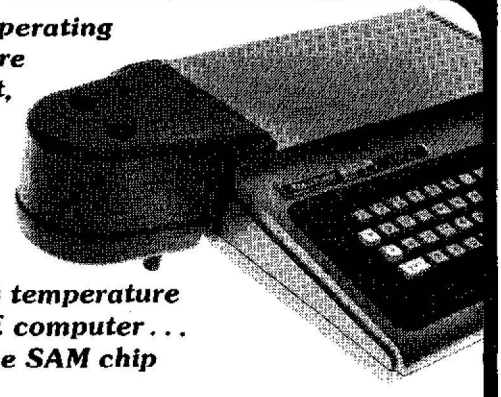
Well, at that point, I quit and went back upstairs. I must have been down in the den for about an hour, and I had forgotten all about my poor little turtle in the living room. When I got back upstairs, he had disappeared and left only a trail (from the pen I had tied to him) that led into the kitchen and behind the fridge. From there the trail disappeared. With certainty, this is a mere coincidence—but two days later I discovered that there were significant supplies missing from the fridge. I've more to say, but it'll have to be next time, I remain,

Uncle Bert

P.S. You can send your cards and letters to me in care of my good friend Dale Peterson. Just address them like this:

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Build This Parallel Printer Interface

By Tony DiStefano
Rainbow Contributing Editor

The *Parallel Printer Interface* is the first project that will adapt to my Y-ER expansion card. After you build this circuit, you will be able to use any parallel printer that is Centronics compatible. This circuit uses one MC6821 PIA. The other two chips used are for decoding the address bus to memory map the PIA from $FF70 to $FF73. The PIA has two functions: 1) to check if the printer is busy and 2) to transfer data to the printer. Bit 0 of port A is used to monitor if the printer is busy. All 8 bits of port B are used to transfer the data to the printer. The Control line CB2 is used to strobe the data into the printer. The PIA is initialized in such a way that CA2 auto strobes when a write to port B is done. Refer to the Motorola MC6821 PIA data sheet for more details on how a PIA works.

To put the circuit together is not too hard, but, like all electronic projects, care should be taken in the process. The circuit is shown in Figure 1. It consists of only three chips. The shopping list below includes everything you need to build the project. The first thing you must do is trim one side of one of the connectors of the project board. I'll explain why later. Look at Figure 2 to get the location of where to cut the board. You have to remove three pads. Well, it is actually six pads because there are three pads on each side. Use a hacksaw to cut the board. Be careful not to cut or scratch any of the other pads. Next, position the IC sockets as shown in Figure 2. Note the position of pin one on each socket. They all go on the bottom and to the left. Position them the same way. Solder all the pins on all of the sockets. The next thing to do is to get the B-Plus and the B-Minus buses in. Turn the card upside down and locate the bus that is parallel to position 5 written on the sides. That will be the ground bus. I traced all the legs of the ground bus with a black grease pencil. This makes finding a ground point easier. The other bus, at location 33 on the sides, will be the B-plus line. That's the 5-volt line. Use a red grease pencil to mark it.

The rest of the soldering on this card will be made following the schematic. Solder the wires one by one, and after each connection is done, mark it on the schematic. This prevents you from trying to connect a wire twice or forgetting others. The small pads that point to the left on the schematic mean that it goes to a pin on the Color Computer cartridge side. The small pads that point to the right mean that it goes on the printer connector side. Refer to Figure 2 to get the proper location of the pinout for both the computer side and the printer side. Note that pin 1 for the computer side is the top of the upper pad and that pin 1 for the printer side is the bottom lower pad. I did it that way because the

(Tony DiStefano is well known as an early specialist in Color Computer hardware projects. He is one of the acknowledged experts on the "insides" of CoCo.)

Shopping List For The Parallel Printer Port

Quantity	Description	RS # (if any)
1	PROJECT BOARD	276-163
1	40 pin IC socket	276-1996
2	16 pin IC socket	276-1998
1	74LS133	N/A
1	74LS138	N/A
1	MC6821	N/A
2	.01 uf CAP	272-1265

Figure 1

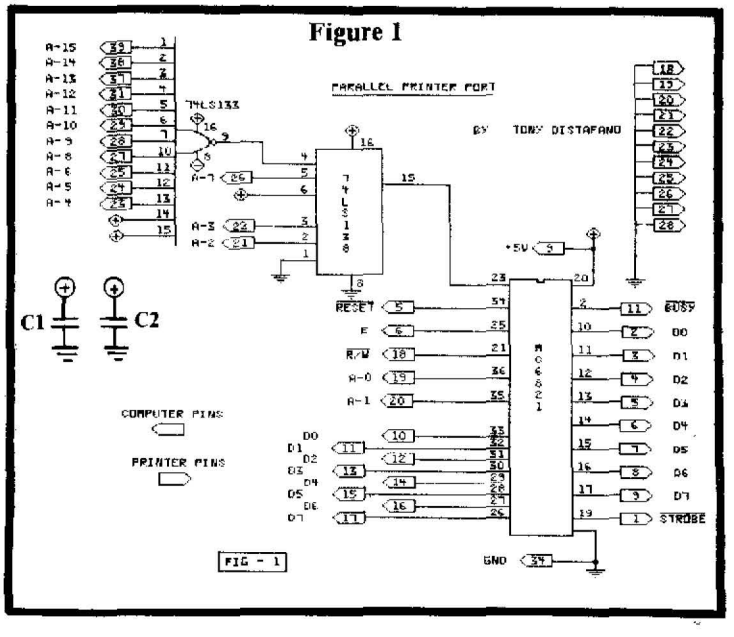
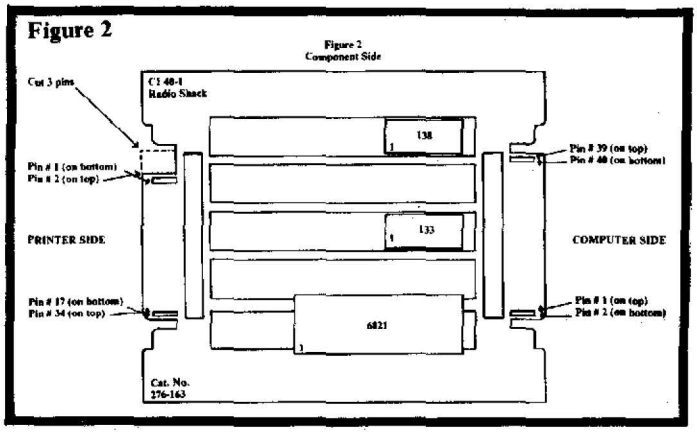


Figure 2



ribbon cable will sit properly in the connector. It will drop downwards. After all the wiring is done, clean the board of the flux residue. This can be done with flux remover, or anything else that will remove the flux. Check your work carefully and make sure there are no shorts or cold solder joints. It would be wise to check the wiring once again.

Put the board aside for now, it's time to concentrate on the printer ribbon cable. You have two choices: 1) buy one from Radio Shack, or 2) make one yourself. The first choice is simple; go to your nearest Radio Shack store and buy printer cable #26-1401. That is a 34-pin edge card to 36-pin plug. It's for a Model I/III to standard parallel printer cable. It will work perfectly. The second choice is a bit more work but will cost you much less. You will need three parts.

1) 34-pin edge card to ribbon connector, RS # 276-1564.
2) 36-pin Centronics type connector, RS # N/A.
3) 6 feet of 34-conductor ribbon wire, RS # N/A.

Take one end of the ribbon wire and connect it to the 34-pin edge card connector. Procedures on how to connect a ribbon wire to a connector are explained in last month's issue in my Y'ER article. Now, the other end is a bit tricky. There are 36 pins and only 34 wires. The last two are not used. When you put the ribbon and the connector together, make sure that the first wire (pin 1 on the edge card connector) meets with pin 1 on the Centronics connector. The last two pins will be left empty. On the connector the empty pin numbers are # 36 and # 18. Then, press the connector in the usual manner. This will give you a printer cable for about half the price of one you would buy.

Okay, now you have the board and the connector. After you are sure that both are constructed right, it's time to plug it in. Now, the computer gives you the familiar logo, but what do you do with it? It doesn't work, does it? You are missing some software to hook it into BASIC. The machine language program listed below will re-route the *PRINT #-2* command to the parallel port. All you have to do to hook it in is *EXEC*. When you type *EXEC* again, it will unhook itself and *PRINT #-2* will again go to the RS-232 port. Be careful that you give it an *ORG* in the right place, and make sure that you reserve enough memory, so you don't crash the program. That's all there is to it!

The listing:

```
                        *   PARALLEL PRINTER ROUTINE
                        *   BY TONY DISTEFANO

0001 0E00                       NAM   PPRINT

0002 0E00                       ORG   $7F00

0003 006F               PRNO    EQU   $6F
0004 009C               CRHOOK  EQU   $9C
0005 0168               PRHOOK  EQU   $168
0006 FF70               PIA     EQU   $FF70

0007 7F00 8EFF70        INIT    LDX   #PIA      PIA LOCATION
0008 7F03 4F                    CLRA
0009 7F04 A701                  STA   1,X       DDR ACCESS A
0010 7F06 A703                  STA   3,X       DDR ACCESS B
0011 7F08 A784                  STA   0,X       ALL INPUT A
0012 7F0A 4C                    INCA
0013 7F0B 979C                  STA   CRHOOK    BASIC IDEO
0014 7F0D 86FF                  LDA   #$FF
0015 7F0F A702                  STA   2,X       ALL OUTPUTS B
0016 7F11 A701                  STA   1,X       CONTROL ACCESS
0017 7F13 862C                  LDA   #$2C      B+STROBE
0018 7F15 A703                  STA   3,X       CONTROL ACCESS
0019 7F17 8E0168                LDX   PRHOOK
0020 7F1A 10BE7F40              LDY   RETURN+1
0021 7F1E BF7F40                STX   RETURN+1
0022 7F21 10BF0168              STY   PRHOOK
0023 7F25 39                    RTS

0024 7F26 3402          PRINT   PSHS  A         PRINT DEVICE #
0025 7F28 966F                  LDA   PRNO
0026 7F2A 81FE                  CMPA  #$FE      TO PRINTER?
0027 7F2C 260F                  BNE   NOGO      NOT PRINTER
0028 7F2E B6FF70        P1      LDA   PIA
0029 7F31 8401                  ANDA  #1        IS PRINTER
0030 7F33 26F9                  BNE   P1        READY?
0031 7F35 3502                  PULS  A         TO PRINTER
0032 7F37 B7FF72                STA   PIA+2     & STROBE
0033 7F3A 3262                  LEAS  2,S       GO BACK TO
0034 7F3C 39                    RTS             CALLER

0035 7F3D 3502          NOGO    PULS  A         NOT FOR PRINTER
0036 7F3F 7E7F26        RETURN  JMP   PRINT     ADDRESS

0037 7F42                       END

NO ERRORS FOUND

CRHOOK 009C  0013
INIT   7F00
NOGO   7F3D  0027
P1     7F2E  0030
PIA    FF70  0007 0028 0032
PRHOOK 0168  0019 0022
PRINT  7F26  0036
PRNO   006F  0025
RETURN 7F3F  0020 0021
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Examining Some Educational Uses Of The Color Computer

By Michael Plog, Ph.D.

When most people talk about educational uses of a computer, two topics are mentioned more than any other—interactive instructional use and teaching BASIC. These are very important uses of microcomputers in schools. Indeed, the BASIC language of the Color Computer is one of the most advanced I have seen. It is far superior to the MBasic used in most minis, and anyone who has programmed an Apple is relieved to get back to Extended Color BASIC. For interactive instruction, the Color Computer is a powerful tool for classroom use. Students can have lessons using color and graphics, as well as enough power and speed for almost any type of application.

There are other uses of computers in education, however. In our haste to have students get "hands on" experience with machines, we should not ignore these other uses. It is my contention that some of these other uses may prove more worthwhile to students, teachers and administrators than either interactive instruction or teaching about computers.

First, consider the *development of materials* for students. The microcomputer is an ideal way to prepare materials uniquely suited for individual students. Spelling words, for example, can be used in work search puzzles or word scrambles for elementary children. A more sophisticated use of the Color Computer for materials development is to prepare individual tests for students, including items missed on past quizzes.

(Michael Plog received his Ph.D. degree from the University of Illinois, the M.S. from Memphis State University, and the B.S. from the University of Tennessee. For his foreign/research language option required for the doctorate, he naturally selected computer language. Michael currently works for the Illinois State Board of Education as a research and evaluation specialist.)

Another important use of a microcomputer, gaining popularity more in recent months, is *management of instruction.* For example, in a high school literature class, a microcomputer is an ideal way of keeping track of books read by students, and their scores on exams on each book. Teachers can easily determine what gaps are present for each student, and design educational experiences to complete the course of study. Management of instruction also involves keeping track of test scores and "modules" completed by students. The major thing to remember is that computer assisted instruction (CAI) is not the same as computer managed instruction (CMI). When teachers use computer managed instruction, students may never come near a machine.

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Another possible use of microcomputers in schools is for *administrative management of information.* The Color Computer is not widely used in this field (to the best of my knowledge), but certainly should be. The printing of class

lists, recording daily attendance, preparation of mailing lists to parents, keeping financial records, information about substitute teachers, are all examples of ways administrators can use microcomputers. The list of uses here is only limited by the imagination and time available to administrators. I even know of some schools that prepare their schedules (what students will be enrolled in which classes) on a microcomputer. The program has to run overnight, but that time is a vast savings compared with older, manual ways of preparing a schedule, or buying time on a mainframe.

One use of microcomputers, *data exchange,* appears to be a high interest topic currently. Some schools have a bulletin board service run out of the computer laboratory—designed and operated by students. On a different level (of more immediate importance to school districts, although not students) electronic mail can be a valuable aid to school people. When a student transfers from one school to another, for example, complete records can be only a telephone call away. The use of electronic mail has other possibilities for educators. When a piece of legislation is being discussed in a state (or even federal) congress, educators can learn of the debates, contact their elected officials, and lobby for their interest. All this can be done in a matter of hours, using electronic mail. In an effort to save time and money, the state of New Jersey is currently testing a system whereby school districts report to the state office via telephone and modem. This example of data exchange may well prove the most financially beneficial use of microcomputers in schools.

There are other uses of microcomputers in education; I have not attempted to exhaust the possibilities, just to classify some major topics. Uses of hardware, for example, could be very important for students with physical disabilities. The day is not too distant when blind students will be able to read teacher developed materials on a brailled computer output. (There are experiments in the field today, but they are still expensive and rare.) With a speech synthesizers, mute children can use their own microcomputers to actually talk with their peers.

Instead of going on about possible uses, let us stop for a moment and regroup. Future articles will present more detailed examples of each of the uses noted briefly above. Right now, however, let me pose a question to you: What is the greatest problem of microcomputer use in education?

No, it is not availability of hardware. The price of the Color Computer is continuing to drop, especially with local Radio Shack monthly sales and educational discounts. Schools can find the money for the purchase of a few machines. The greatest problem is knowledge about quality software available for schools. Now note—I said *knowledge* about quality software, not the existence of quality software. I will bet dollars to doughnuts that every reader has purchased a program and felt they were the victim of fraud. Likewise, every reader has purchased a program and been willing to pay twice the price because of the value received. The problem is knowing the difference before purchasing. Well, I am going to suggest a potential solution to this problem next month. Please tune in and read the article, because I will need your help. By the way, next month's issue of *the Rainbow* is devoted to education and the Color Computer! Should be interesting.

As a final shot, if you have an experience or thought to share about microcomputers in education (especially, but not limited to, the Color Computer), please write me. I would very much like to know your views and ideas. My address is 829 Evergreen, Chatham, Illinois 62629.

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The Powerful *QSort* Routine Comes To The Color Computer

Part Two

By Colin J. Stearman

This two part article brings to the Color Computer a fast and versatile number and string sorting routine. In addition, we will explore the way numbers and strings are represented by Microsoft BASIC.

Colin Stearman's ***Quicksort*** *program for the Color Computer should not be confused with a similar program of the same name available commercially through Skyline Marketing. Their ad appears in this issue of* ***the Rainbow****.*

In the last issue we looked at *Quicksort* implemented in BASIC. Now we will look at a machine code version which offers significant speed and flexibility while occupying around 1.5K of memory space. The program is written in Position Independent Code or PIC for short. This means it will work correctly no matter where it is loaded in memory. Although this adds somewhat to its overall length, it provides the ability to append it to a BASIC program using one of the many previously described techniques. The assembly was performed at address E00 (hexadecimal) as this is the normal starting address of graphic screen 1 when running Disk Extended Color BASIC.

Design Considerations

As I mentioned in the previous installment, the *Quicksort* implementation by Don Brumm for the TRS-80 Model I was my model for the Color Computer version. However, it used a technique which had some problems when transfered to the Color Computer. Instead of actually sorting the array in question, Don chose to sort an index array of integers. Then this array could be used to access the "sorted" array. By this technique the subscript of the 10th element in the "sorted" array is the value of the 10th element in the integer array. By using the one level indirection, it was not necessary to actually rearrange the original array.

The problem with this approach is that the Color Computer does not have integer arrays. All number arrays are floating point, and as I described earlier, each number takes up five bytes of memory. So if we wished to sort an array of 4096 elements, the index array would also have to contain 4096 elements. This alone would take up 4096 x 5 bytes, plus seven more for the array header. This is 20487 bytes! Hardly a practical proposition in a 32K system. If integer arrays had been possible, the index array would only occupy 8192 bytes. So the first design decision was obvious. We would have to sort the array itself.

At the outset, we set some goals which the sort must achieve. To refresh your memory they were:

- Sort string or number arrays
- Sort in ascending or descending order
- Sort a part of an array only
- Have good call error checking
- Sort 1 or 2 dimensioned arrays
- Include or exclude 2nd dimension in sort
- Sort either 1st or 2nd dimension

This flexibility calls for a method of communication between BASIC program using the routine, and the routine itself. Don Brumm used the index array for this, so we might as well use a similar system. Because we will not be using the array as an index array, however, let's call it a parameter array. This array will contain data on how to conduct the sort. This information will tell the routine which subscript to start the sort at; which one to end on; the order; the array to sort; and, if a string sort, which elements of each string to use for comparison purposes. The first element of the parameter array is then pointed to by the *VARPTR* function in the call routine.

Call Error Checking

This only leaves the call error checking. The BASIC line which calls the routine is in the form "X=USR(n)." The variable "X" can be given a value by the machine code routine. This variable is used to return a value which describes the success or failure of the call, and the nature of the problem, if any. If the variable has the value zero, the sort was successful. Any other value indicates a problem. The codes and their meanings are:

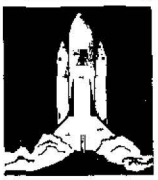
0 SORTED WITHOUT ERROR

(Mr. Stearman is Field Engineering Manager for Boston Digital Corp., a manufacturer of precision, computer-controlled milling machines. He was born and educated in England and has lived in the U.S.A. since 1970.)

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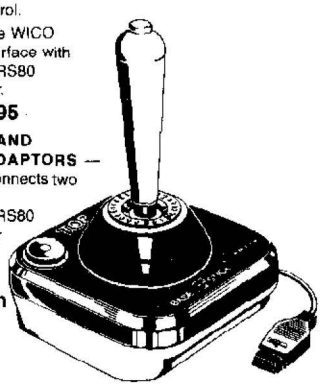
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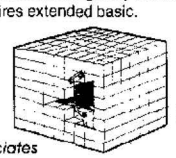
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2 PARAMETER ARRAY NAME ERROR. This array must be called "I" or "I*", where "*" can be any letter.
2 PARAMETER ARRAY DIM ERROR. Parameter array must be unidimensional.
3 PARAMETER ARRAY NOT NUMERIC. Parameter array cannot be a string array.
4 PASSED NO. OF ELEMENTS>4096 OR 0. You can sort an array longer than 4096 elements, but you can only sort 4096 elements of it at a time.
5 INSUFFICIENT DATA IN PARAMETER ARRAY. You must define elements 1 and 2 as a minimum.
6 ERROR IN I(3) VALUE (0 THROUGH 3 ONLY). This selects the dimensions in two dimension array sorts, and has only these four legal values.
7 SORT ARRAY NAME ERROR. The sort array must be named "A" or "A*" for numeric, or "A$" or "A*$" for strings. "*" is any letter.
8 SORT ARRAY DIM ERROR. Sort array must be unidimensioned, or two dimensioned, with the second dimension a 1.
9 INCONSISTENT SORT ARRAY SIZE. Sort array dimension is not consistent with values given parameter array, elements 0 and 1.
10 I (3) VALUE INCONSISTENT WITH NO. OF SORT ARRAY DIMENSIONS. You cannot use one through three if the sort array is unidimensional.

By inspecting the returned value it should be possible to debug most of the difficulties calling the routine.

The Assembly Language Version

I do not propose to "walk" you through the program shown in Listing 3. It would consume far too much space on these pages, and I suspect also consume far too much of your patience! I have tried to comment the assembly listing so that those curious amongst you can see how it was done. The program itself breaks down into various sections. First data space is reserved and a particularly useful macro is defined. Following this is the mainline of the program. Notice it is not very long and represents the whole program. Mostly it consists of calls to other subroutines. Closer inspection will reveal the general flow of the program.

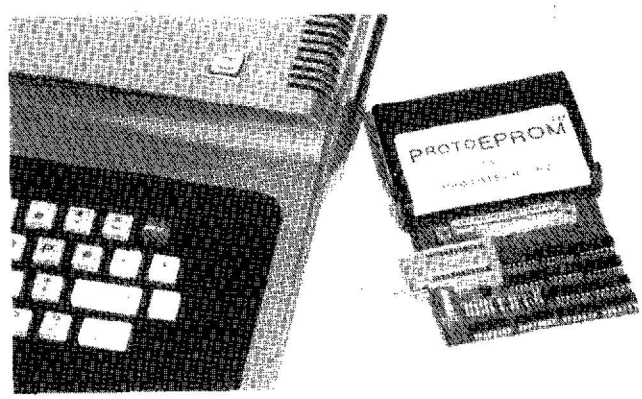
The subroutines which follow perform these general functions:

GETNUM — uses a subroutine in BASIC to convert a floating point number to a 16 bit integer.
INTRL — the reverse of GETNUM.
INIT — does all the initialization and call error checking.
ARKCHK — is used by INIT to check an array's header.
GETPTR — returns the address of an element in an array, given its subscript.
UNSTCK — gets the partition data from the stack to sort next.
LSCAN and RSCAN — scan the current partition from left and right respectively, for matches to the comparand.
SWAP — exchanges elements found by LSCAN and RSCAN.
RGTSTK and LFTSTK — stack the right and left partition data respectively, for later sorting.

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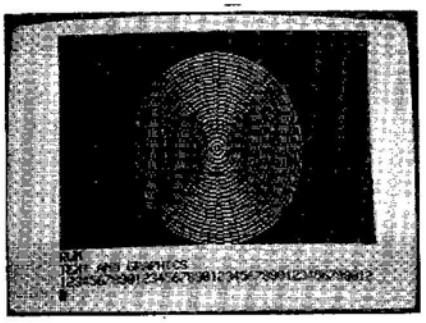
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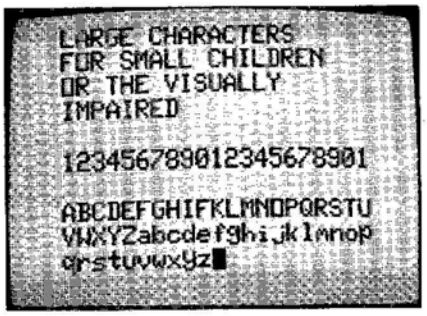


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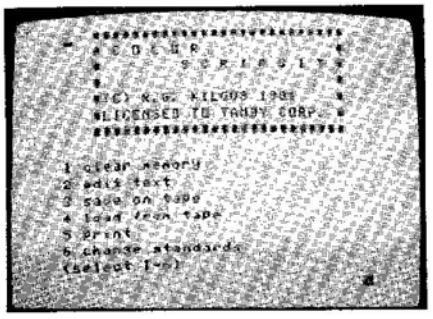
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CMPNUM — is used by COMPAR to compare numeric array elements.
CMPSTR — is used by COMPAR to compare string array elements.
EZSORT — is a complete implementation of the simple sorting procedure.

With this information you should be able to understand the detailed operation of the program.

Using *QSORT*

Listing 1 shows the test routine I used to check *QSORT* for "bugs." It is designed for Color Computers with 32K, Extended BASIC and a disk. If you do not have disks, line 20 can be changed to *CLOADM* to get the *QSORT* routine off a cassette. It assumes that *QSORT* is located at the assembly address of E00 (HEX). The actual starting address of the routine is 4E (HEX) beyond the load point. When loaded at E00 the starting address would be E4E.

"Quicksort . . . offers significant speed and flexibility while occupying around 1.5K of memory space."

It is designed to sort a random array of numbers, but can be simply modified to demonstrate string sorting. The key lines are as follows:

50 DIM A(999),I(2),B(3)

A is the numeric array being sorted. I is the parameter array. B holds the timer values.

140 I(0)=0:I(1)=K9:I(2)=VARPTR(A(0))

I(0) defines the lowest subscript to start the sort on, I(1) the highest. I(2) uses VARPTR to point to the address of the zeroth element of the sorted array.

170 X = USR(VARPTR(I(0)))

calls *QSORT* jumping to the address defined in line 40. The argument uses *VARPTR* to point to the *zeroth* element of the parameter array. The variable X will contain the call status value and is checked on the following line. Note that X was predefined on line 90. If it was being defined for the first time on line 170 the value returned by *VARPTR* to I(2) on line 140 would no longer be correct.

Listing 2 shows a more complex call to *QSORT*. It is designed to provide an alphabetic directory of the selected disk drive floppy. After extracting the file names from the directory track it sorts them first by file type, then by name. The important lines to note are:

20 DIM AX$(63),I(7)

AX$ is the string array to be sorted. Allowing a second letter for the string array name permits a program to sort several arrays. I is the parameter array.

35 RC=0

preassigns the calling variable.

190 I(0)=0

begins the sort with element zero.

195 I(1)=R-1

determines the last element to sort. This ensures higher, but blank, elements stay where they are.

200 I(2) = VARPTR(AX$(0))

points to the array to be sorted.

205 I(4)=10:I(5)=12:I(6)=1:I(7)=8

says first sort by elements 10 through 12, then by elements 1 through 8. This gets the result in file type order first, then by file name. I(3) is undefined and hence zero.

220 RC=USR(VARPTR(I(0)))

calls the *QSORT* routine and points to the parameter array.

Exact Calling Requirements

Now we've looked at a couple of calling examples, let's define the exact requirements in general terms.

First the sorting array must be a one or two letter named string or number array with the first letter an "A." It must be unidimensional, or two dimensional with the second dimension set to one. It can be over 4096 elements on size, but only 4096 elements can be sorted at one time.

The parameter array must be numeric and have at least three elements. It must have a name of one or two letters, starting with an "I." It must have enough elements to handle all the desired data to be given to the *QSORT* routine.

Now let's look at the parameter array itself. Elements zero and one describe the subscript range on which to sort. If the zeroth element is lower than the first, the sort is ascending. Otherwise it will be descending.

Element two points to the zeroth element of the sorted array using the function *VARPTR*. If it is a two dimensional array, it must point to the (0,0) element. For example, I(2)=VARPTR(AZ(0,0)).

The third element is always zero for unidimensional sort arrays. If the sort array is two dimensional, this element determines which elements in the array are sorted and moved. The effect of variable I(3) is as follows:

I(3)=0 Sort (n,0), Leave (n,1)
I(3)=1 Sort (n,0), Move (n,1)
I(3)=2 Sort (n,1), Leave (n,0)
I(3)=3 Sort (n,1), Move (n,0)

The virtue of making I(3) equal to 1 and 3 is that a group of data from a larger group can be sorted along with a pointer to the rest of the data. For example, the sorted array could contain names, with the second dimension pointing to the record number of the associated addresses.

The remaining subscripts of the parameter array determine string element order for sorting purposes. They should be considered in pairs, as defining the character range and priority when sorting string arrays. With numeric arrays

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they have no significance. If undefined, the comparison of strings will be made across the whole string starting at the leftmost character. Undefined means that the "I" array is dimensioned so that the subscript in question is outside the array bounds. This is not the same as defining it as zero.

However, by defining the values, the comparison order can be changed. For example, if element seven is set to 3 and the remainder undefined, comparison will start at character 3 of the string and continue to the end. Characters 1 and 2 will not be considered. If element eight is defined as 10, only characters 3 through 10 will be considered in the comparison, with all others ignored. If element nine is defined as 20 and 10 as 30, then after considering characters 3 through 10, characters 10 through 20 will be further considered when the comparison is made. Using this technique, the order of character comparison can be controlled. If the second element of a definition pair is undefined, then the end of the string is assumed.

"It is slightly slower than Don Brumm's Model I version, sorting 1000 strings in 16 seconds (but) . . . a few seconds is well worth trading in for the increased power the various sorting modes offer."

The minimum acceptable call to *QSORT* is when the parameter array is dimensioned I(2) and when I(1) is set to the number of the last element to sort, and I(2) is set to point to the array to sort. This assumes that I(0) is left at its initialized value of zero.

QSORT Performance

Running the program in listing 1 will give an indication of the kind of performance you can expect from *QSORT*. By all accounts it is fast. The time from one run to the next varies slightly. This is due to the random selection of the comparand.

Sometimes it more often hits a near median value, and the sizes of the resulting sub-partitions are more nearly equal. However, it rarely varies that much, indicating the validity of a random comparand selection.

It is slightly slower than Don Brumm's model I version, sorting 1000 strings in 16 seconds. Sorting 3000 strings will take about 45 seconds. When numeric arrays are sorted, 1000 numbers take about 8 seconds and 3000 numbers about 23 seconds. The decreased performance for string sorts is the price paid for a significant increase in the flexibility of the routine. A few seconds is well worth trading in for the increased power the various sorting modes offer.

In Summary

Besides providing you with a useful, fast and versatile sorting routine, this article should have provided you with an insight into how to go about writing routines in assembly language. Initial implementation in BASIC ensures that the concept is fully understood, before digging into the machine code. Also it should give you a feel for the power of the MC6809 microprocessor at the heart of the Color Computer. This powerful 8 bit computer has many 16 bit instructions, many of which have been used in this routine.

If you want this utility in your collection but are daunted by the typing, or lack of an assembler, I would be happy to provide a copy to you. Just send a check or money order for $6, plus a blank cassette or floppy disk (5.25 inch) to Colin J. Stearman, 143 Ash Street, Hopkinton, MA 01748. I will put on it a copy of the source listing along with a binary file of *QSORT*.

Listing 1:

```
10 GOTO380
20 LOADM"QSORT"
30 CLS:CLEAR 2000
40 DEFUSR=&HE4E
50 DIM A(999),I(2),B(3)
60 TIMER=0
70 FOR K9=199 TO 999 STEP 200
80 PRINT@448,"BUILDING ARRAY"
90 X=0:B(0)=TIMER
100 FOR J=K9-199 TO K9
110 A(J)=RND(5000)-2500
120 PRINT@64,"ELEMENT #";J;
130 NEXT J
140 I(0)=0:I(1)=K9:I(2)=VARPTR(A
(0))
150 PRINT@448,"SORTING ARRAY"
160 B(1)=TIMER
170 X=USR(VARPTR(I(0)))
180 IF X>0 THEN PRINT"ERROR CODE
=";X:STOP
190 PRINT@448,"VERIFYING ARRAY"
200 B(2)=TIMER
210 FOR J=0 TO K9-1
220 IF A(J)>A(J+1) THENPRINTJ;A(
J);A(J+1):STOP
230 NEXT J
240 B(3)=TIMER
250 PRINT@132,"SORT OF ";K9+1;"
ELEMENTS"
260 PRINTUSING"ARRAY BUILD START
 WAS ###.##";B(0)/60
270 PRINTUSING"              END
 WAS ###.##";B(1)/60
280 PRINTUSING"SORT ENDED AT ---
---- ###.##";B(2)/60
290 PRINTUSING"VERIFY ENDED AT -
---- ###.##";B(3)/60
300 PRINTUSING"SORTING TIME WAS
---- ###.##";(B(2)-B(1))/60
310 PRINT:PRINT
320 TTL=TTL+((B(2)-B(1))/60)
330 NEXT K9
340 PRINTUSING"TOTAL SORT TIME -
---- ###.##";TTL
350 PRINT@448,"TEST COMPLETE."
360 INPUT"AGAIN (Y/N)";R$
370 IF R$="Y"THEN RUN 30  ELSE E
ND
380 PCLEAR2:GOTO20
```

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THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

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...one of the best programs for the Color Computer I have seen...
— Color Computer News, Jan. 1982

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But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

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64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24!! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPVII/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

...truly a state of the art word processor... outstanding in every respect.
— The RAINBOW, Jan. 1982

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RAINBOW CERTIFICATION SEAL

Listing 2:

```
10 CLEAR 3000
20 DIM AX$(63),I(7)
30 DEF USR=&HE4E
35 RC=0
40 CLS
60 INPUT"DRIVE #";DR
65 INPUT"LISTING TO PRINTER";A$
66 IFA$="Y" THEN DV=-2 ELSE DV=0
70 IF DR<0 OR DR>1 THEN 40
80 FOR X= 3 TO 11
90 DSKI$ DR,17,X,A$,B$
100 A$=A$+LEFT$(B$,127)
110 FOR N=0 TO 7
120 FILE$=MID$(A$,N*32+1,8)
130 EXT$=MID$(A$,N*32+9,3)
140 IF ASC(FILE$)=0 THEN 180
150 IF FILE$=STRING$(8,255) THEN
 180
160 AX$(R)=FILE$+"."+EXT$
170 R=R+1
180 NEXT N,X
190 I(0)=0
195 I(1)=R-1
200 I(2)=VARPTR(AX$(0))
205 I(4)=10:I(5)=12:I(6)=1:I(7)=
8
210 PRINT"CALLING SORT"
220 RC=USR(VARPTR(I(0)))
230 IF RC<>0 THEN PRINTRC:STOP
240 FOR X=1TOR
241 IF INT(X/16)=X/16 AND DV=0
THEN A$=INKEY$:IF A$=""THEN 241
251 PRINT#DV,USING"## -- %
    %";X,AX$(X-1)
260 NEXT
```

Listing 3:

```
                0001 ********************************
                0002 *        QUICKSORT             *
                0003 *                              *
                0004 *    FOR THE TRS-80 COLOR      *
                0005 *         COMPUTER             *
                0006 *                              *
                0007 * (C) 1983 COLIN J STEARMAN     *
                0008 *                              *
                0009 ********************************
9E00            0010        ORG   $9E00
                0011 *
                0012 ********************************
                0013 *MEMORY ALLOCATIONS
                0014 ********************************
```


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```
0E00            0015 BEGIN  RMB   2          CURRENT PARTITION START
0E02            0016 ENDING RMB   2          CURRENT PARTITION END
0E04            0017 LI     RMB   2          LEFT SCANNING INDEX
0E06            0018 RI     RMB   2          RIGHT SCANNING INDEX
0E08            0019 CMPADD RMB   5          COMPARAND STORAGE
                0020 *WILL BE NUMBER OR POINTER TO STRING
0E0D            0021 STACK  RMB   2*12*2      PARTITION STACK SPACE
0E3D            0022 MTPTR  RMB   2          RETAINS VALUE OF U WHEN AT STACK TOP
                0023 * WHEN STACK IS EMPTY
0E3F            0024 VPTRI  RMB   2          ADDRESS OF I(0)
0E41            0025 IFLAG  RMB   1          0 IF REGULAR SORT, 1 IF SPECIAL SORT
0E42            0026 VPTRA  RMB   2          ADDRESS OF A(0) OR A$(0)
0E44            0027 ASLAVE RMB   2          SLAVE DIMENSION ADDRESS
0E46            0028 DIMEN  RMB   1          0,1,2 DIMENSION TO SORT IN BIDIM ARRAY
0E47            0029 SORTYP RMB   1          TYPE OF SORT
0E48            0030 CNEQ   RMB   1          0 IF STRINGS ARE
                0031 *BOTH EQUAL TO COMPARAND, NOT 0 ELSE
0E49            0032 SORDER RMB   1          0=ASCENDING,1=DESCENDING
0E4A            0033 ICOUNT RMB   2          VARIABLE TO COUNT
                0034 *ELEMENTS USED FROM I
0E4C            0035 SCSTRT RMB   1          SCAN START FOR STRING COMPARE
0E4D            0036 SCEND  RMB   1          SCAN END FOR STRING COMPARE
                0037 ****************************
                0038 *      EQUATES
B4F4            0039 BASIC  EQU   $B4F4      RETURN TO BASIC WITH VALUE IN D
B3ED            0040 INTCNV EQU   $B3ED      BASICS FP0-INT ROUTINE
BF1F            0041 RND    EQU   $BF1F      BASICS RANDOM ROUTINE
004F            0042 FAC    EQU   $4F        ADDRESS OF FLOATING POINT ACC.
0E4E            0043 PARTTN REG   X,Y        PARTITION POINTERS X IS LEFT, Y RIGHT
                0044 ****************************
                0045 * MACRO MOVE5
                0046 ****************************
                0047 ***  MACRO DEFINITION
                0048 * MOVES 5 BYTES FROM ADDRESS IN 1ST REGISTER
                0049 *TO ADDRESS IN SECOND
                0050 *
                0051 MOVE5  MACR
                0052        LDB   #4         COUNTER
                0053 \.0    LDA   B,\0       GET BYTE
                0054        STA   B,\1       MOVE IT
                0055        DECB
                0056        BPL   \.0        LOOP UNTIL B NEG
                0057        ENDM
                0058 ****************************
                0059 *
                0060 ****MAINLINE PROGRAM********
                0061 ****************************
                0062 *
0E4E 3460       0063 QSORT  PSHS  Y,U        PRESERVE BASICS REGISTERS
0E50 17008E     0064        LBSR  INIT       CHECKS FOR ERRORS IN CALL
0E53 5D         0065        TSTB             B IS ZERO IF ALL OK
0E54 2706       0066        BEQ   CALLOK
                0067 *B HAS ERROR CODE IF NOT OK
0E56 4F         0068 EXIT   CLRA
0E57 3560       0069        PULS  U,Y        RESTORE BASICS REGISTERS
0E59 7EB4F4     0070        JMP   BASIC      RETURN VALUE
                0071 ****************************
0E5C 17024F     0072 CALLOK LBSR  UNSTCK     UNSTACK NEXT SET OF POINTERS
                0073 *IF B IS ZERO NO MORE TO UNSTACK SO EXIT
0E5F 5D         0074        TSTB
0E60 27F4       0075        BEQ   EXIT
                0076 ****************************
                0077 * TEST BEGIN & ENDING FOR SIZE OF PARTITION
0E62 EC8C9D     0078 CKSIZE LDD   ENDING,PCR
0E65 A38C98     0079        SUBD  BEGIN,PCR
0E68 10830009   0080        CMPD  #9
                0081 *IF 10 OR LESS ELEMENTS SORT BY EASISORT,
                0082 *ELSE DO BY QUICKSORT
0E6C 2331       0083        BLS   EZSRT
                0084 ****************************
                0085 **START OF QSORT CALLS**
0E6E 170399     0086        LBSR  RNDCMP     GET RANDOM COMPARAND
0E71 17025A     0087 SCAN   LBSR  LSCAN      SCAN FROM LEFT
0E74 170280     0088        LBSR  RSCAN      SCAN FROM RIGHT
                0089 *TEST FOR CROSSED OR CONCURRENT INDICES
0E77 EC8C8C     0090        LDD   RI,PCR     GET RIGHT INDEX
0E7A 10A38C86   0091        CMPD  LI,PCR     SUBTRACT LEFT INDEX
                0092 *IF RESULT IS ZERO OR NEGATIVE THEY HAVE CROSSED
0E7E 2F05       0093        BLE   CROSS
                0094 *NOT CROSSED TO SWAP
0E80 170295     0095        LBSR  SWAP
0E83 20EC       0096        BRA   SCAN       CONTINUE SCANNING
                0097 ****************************
0E85 17036A     0098 CROSS  LBSR  PARTSZ     COMPARES RIGHT & LEFT PARTITIONS
                0099 *AND SETS C FLAG IF RIGHT>LEFT
0E88 2505       0100        BCS   RIGHT
0E8A 170339     0101        LBSR  LFTSTK     STACK LEFT AS EQUAL OR LARGER
0E8D 2003       0102        BRA   NXTPRT     PREPARE OTHER PARTITION
                0103 ****************************
0E8F 170309     0104 RIGHT  LBSR  RGTSTK     STACK RIGHT PARTITION
                0105 *COMPARE SIZE OF REMAINING PARTITION FOR 1 OR LESS ELEMENTS
0E92 EC8DFF6C   0106 NXTPRT LDD   ENDING,PCR
0E96 10A38DFF65 0107        CMPD  BEGIN,PCR
0E9B 2FBF       0108        BLE   CALLOK
0E9D 20C3       0109        BRA   CKSIZE     CONTINUE SORTING
                0110 ****************************
                0111 *USE EZSORT ON 10 OR LESS
0E9F 1704E0     0112 EZSRT  LBSR  EZSORT
0EA2 2008       0113        BRA   CALLOK     UNSTACK NEXT PARTITION
                0114 ****************************
                0115 *END OF MAINLINE
                0116 ****************************
                0117 *
                0118 *GETNUM RETURNS A VALUE INTO D
                0119 *WHICH IS THE 16 BIT INTEGER OF
                0120 * A FLOATING POINT NUMBER POINTED
                0121 *TO BY THE ADDRESS IN X
                0122 *STORED IN MEMORY TYPE FORMAT
                0123 *THIS WILL LOAD FAC WITH NUMBER
                0124 * CONVERTED TO APPROPRIATE FORMAT
                0125 *THEN INTCNV IS USED TO RETURN VALUE
                0126 *
0EA4 108E004F   0127 GETNUM LDY   #FAC       POINT Y TO FAC
                0128 *MOVE 5 BYTES FROM MEMORY TO FAC
                0129        MOVE5 X,Y
```




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```
0EAB C604           +       LDB   #4          COUNTER
0EAA A685           +.00000 LDA   B,X         GET BYTE
0EAC A7A5           +       STA   B,Y         MOVE IT
0EAE 5A             +       DECB
0EAF 2AF9           +       BPL   .00000      LOOP UNTIL B NEG
                    0130 *NOW FIX FOR FAC FORMAT
0EB1 A621           0131    LDA   1,Y         GET SECOND BYTE
0EB3 A725           0132    STA   5,Y         STORE IN SIXTH BYTE
0EB5 8A80           0133    ORA   #%10000000  SET BIT 7 TO 1
0EB7 A721           0134    STA   1,Y         PUT IN BYTE 2
                    0135 ** FAC IS ALL SET SO CALL INTCNV
0EB9 1F21           0136    TFR   Y,X         POINT X AT FAC FOR INTCNV
0EBB BDB3ED         0137    JSR   INTCNV
                    0138 *NUMBER IS NOW IN D
0EBE 39             0139    RTS
                    0140 ****************************
                    0141 *
                    0142 ****************************
                    0143 * RELOCATABLE CONVERTER FROM
                    0144 * POSITIVE INTEGER TO A REAL
                    0145 * NUMBER.  NUMBER IS IN D AS
                    0146 * A POSITIVE NUMBER IN THE
                    0147 * RANGE 0 - 7FFF.  X POINTS
                    0148 * TO BASE ADDRESS OF RECEIVING
                    0149 * VARIABLE.  Y IS USED
                    0150 * INTERNALLY.
                    0151 ****************************
                    0152 * FIRST TEST FOR 0 IN D
0EBF 5D             0153 INTRL  TSTB              DO LOWER HALF
0EC0 2606           0154    BNE   NTZERO
0EC2 4D             0155    TSTA                  CHK UPPER HALF
0EC3 2E03           0156    BGT   NTZERO
                    0157 *NUMBER IS ZERO OR NEGATIVE SO CLEAR EXPONENT
                    0158 *AND RETURN AS ZERO
0EC5 6F84           0159    CLR   ,X              EXPONENT
0EC7 39             0160    RTS
                    0161 *NUMBER IS NOT ZERO
0EC8 108E0010       0162 NTZERO LDY   #16         BASE POWER COUNT
                    0163 *SHIFT D LEFT ONE PLACE BY DOING B THEN A
0ECC 58             0164 AGAIN  LSLB              TOP BIT INTO CARRY
0ECD 49             0165    ROLA                  CARRY INTO BOTTOM
0ECE 313F           0166    LEAY  -1,Y            DECREASE COUNT
                    0167 *HAS NUMBER GONE NEGATIVE?
0ED0 2AFA           0168    BPL   AGAIN           NO SO SHIFT AGAIN
                    0169 *STRIP TOP BIT AND MOVE D INTO ARRAY
0ED2 847F           0170    ANDA  #%01111111
0ED4 ED01           0171    STD   1,X
                    0172 *FIX Y FOR EXPONENT.  ADD 128 TO IT AND
                    0173 *STORE IN FIRST BYTE OF VARIABLE
0ED6 1F20           0174    TFR   Y,D             MOVE INTO D
0ED8 CA80           0175    ORB   #%10000000      SET 128 BIT
0EDA E784           0176    STB   ,X              STORE EXPONENT
                    0177 *NOW CLEAR REMAINING BYTES
0EDC 6F03           0178    CLR   3,X
0EDE 6F04           0179    CLR   4,X
                    0180 *ALL DONE SO RETURN
0EE0 39             0181    RTS
                    0182 *
                    0183 ****************************
                    0184 *THIS INITIALIZES EVERYTHING
                    0185 *AND CHECKS VALIDITY OF CALL
                    0186 *
                    0187 *ORDER OF CHECKING AND RETURNED VALUE TO BASIC IS:
                    0188 *
                    0189 *     0 = SORTED WITHOUT ERROR
                    0190 *     1 = PARAMETER ARRAY NAME ERROR
                    0191 *     2 = PARAMETER ARRAY DIM ERROR
                    0192 *     3 = PARAMETER ARRAY NOT NUMERIC
                    0193 *     4 = PASSED NO. OF ELEMENTS>4096 OR ZERO
                    0194 *     5 = INSUFFICIENT DATA IN PASSING ARRAY
                    0195 *     6 = ERROR IN I(3) VALUE (0,1,2 ONLY)
                    0196 *     7 = SORT ARRAY NAME ERROR
                    0197 *     8 = SORT ARRAY DIM ERROR
                    0198 *     9 = INCONSISTENT SORT ARRAY SIZE
                    0199 *    10 = I(3) VALUE INCONSISTENT WITH # OF A DIMENSIONS
                    0200 *
                    0201 *REGISTER B IS USED TO RETURN THE CODE TO THE MAIN PROGRAM
                    0202 ****************************
                    0203 *THIS ALSO SETS UP THE FOLLOWING:
                    0204 * U REGISTER TO LAST PUSHED PARTITION VALUE
                    0205 *ORDER OF STACKING IS LEFT THEN RIGHT,
                    0206 *ORDER OF UNSTACKING IS RIGHT THEN LEFT
                    0207 *
                    0208 *THE FIRST PARTITION VALUES ARE PUT ONTO THE STACK.
                    0209 *IF THERE IS ONLY ONE ELEMENT IN ARRAY THEN
                    0210 *NOTHING IS STACKED
                    0211 *
                    0212 *THE NUMBER OF ELEMENTS IS PUT INTO COUNT
                    0213 *THE ADDRESS OF I(0) IN VARPTI
                    0214 *THE ADDRESS OF A(0) OR A$(0) IN VARPTA
                    0215 *THE SORT TYPE IS PUT IN SORTYP
                    0216 *  0 = STRING SORT
                    0217 *  1 = NUMERIC SORT
                    0218 * THE SORT ORDER IS IN SORDER:
                    0219 *     0=ASCENDING
                    0220 *     1=DESCENDING
                    0221 *
                    0222 ***
                    0223 *THE SORTED VARIABLE MUST BE CALLED "A*" OR "A*$" AND THE
                    0224 *PARAMETER ARRAY
                    0225 * MUST BE CALLED "I*".  WHERE * IS ANY LEGAL CHARACTER
                    0226 * "A" ARRAY CAN BE EITHER SINGLE
                    0227 *DIMENSIONED, OR 2 DIMENSIONED.
                    0228 *IF 2, THEN SECOND DIMENSION MUST BE 1.
                    0229 *FOR EXAMPLE:  A$(300,1)
                    0230 *IN THIS EXAMPLE EITHER THE A$(0,0) THRU A$(300,0) SECTION
                    0231 *OR A$(0,1) THRU A$(300,1) SECTION
                    0232 *CAN BE SORTED.  IN ADDITION,
                    0233 *THE OTHER SECTION CAN BE MOVED WITH THE SORTED
                    0234 *ONE OR NOT, AS DESIRED.
                    0235 *MINIMUM CALL FROM BASIC IS:
                    0236 *
                    0237 *       DIM I(2),A$(N) [OR A(N)]
                    0238 *     I(0)=FIRST SUBSCRIPTS TO SORT
                    0239 * IF ASCENDING, LAST IF DESCENDING
                    0240 *       I(1)=LAST SUBSCRIPT TO SORT IF ASCENDING,
                    0241 *FIRST IF DESCENDING
                    0242 *     I(2)=VARPTR(A$(0)) OR VARPTR(A(0))
```


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```
                        0243 *     RC=USR0(VARPTR(I(0))
                        0244 *PREDEFINE RC BEFORE USING IN ABOVE LINE
                        0245 *
                        0246 *STRING ARRAYS CAN BE SORTED IN OTHER THAN LEFT-RIGHT
                        0247 *CHARACTER ORDER.
                        0248 *TO SPECIFY, USE FURTHER ELEMENTS IN I ARRAY
                        0249 *TO DEFINE CHARACTERS TO SORT THROUGH.
                        0250 *EG. TO SORT THE 9TH THRU 12TH, THEN 1ST THRU 8TH
                        0251 *USE:
                        0252 * I(3)=9:I(4)=12:I(5)=1:I(6)=8
                        0253 * IF THE 2ND OF A PAIR IS MISSING
                        0254 *255 IS ASSUMED.
                        0255 *
                        0256 *IF SORT ARRAY IS DIMENSIONED (N,1) THEN:
                        0257 *  I(3)=0 THEN SORT (0,1)-(N,1)
                        0258 *         AND LEAVE (0,0)-(N,0) AS IS
                        0259 *   I(3)=1 SORT (0,1)-(N,1) AND MOVE OTHER SECTION TOO
                        0260 *   I(3)=2 THEN AS I(0) BUT MOVE OTHER SECTION TOO
                        0261 ****************************
                        0262 *GET POINTER TO I(0)
0EE1 BD83ED             0263 INIT   JSR   INTCNV
0EE4 ED8DFF57           0264        STD   VPTRI,PCR
0EE8 1F01               0265        TFR   D,X          SO X POINTS TO I(0)
0EEA 3410               0266        PSHS  X            PRESERVE POINTER
0EEC 300A               0267        LEAX  10,X         MOVE X TO I(2)
0EEE 17FFB3             0268        LBSR  GETNUM       GET POINTER TO A(0) OR A$(0)
0EF1 ED8DFF4D           0269        STD   VPTRA,PCR
                        0270 ************************
                        0271 * NOW CHECK I ARRAY VALIDITY
0EF5 3510               0272        PULS  X                 POINT AT I(0)
0EF7 8649               0273        LDA   #'I          ARRAY FIRST LETTER
0EF9 17F163             0274        LBSR  ARYCHK       RETURNS 0,1, OR 2 IN B
                        0275 *B IS ZERO IF NAME OK
0EFC 5D                 0276        TSTB
0EFD 2705               0277        BEQ   CHKTYP
0EFF 2A02               0278        BPL   GOTERR       -1 IS BAD TOO
0F01 C602               0279        LDB   #2
0F03 39                 0280 GOTERR RTS                AND RETURN
                        0281 ****
                        0282 *CHECK FOR TYPE OF ARRAY
0F04 C101               0283 CHKTYP CMPA  #1           SHOULD BE 1 FOR NUMBER ARRAY
0F06 2703               0284        BEQ   IISNUM
0F08 C603               0285        LDB   #3           ERROR CODE
0F0A 39                 0286        RTS                AND RETURN
                        0287 ****
                        0288 *GET VALUE IN I(0)
0F0B 3430               0289 IISNUM PSHS  Y,X          PRESERVE ARRAY SIZE AND X POINTER
0F0D 17FF94             0290        LBSR  GETNUM       D WILL FIRST PARAMETER
0F10 AEE4               0291        LDX   ,S           RECOVER X POINTER LEAVE ON STACK
0F12 3406               0292        PSHS  D            SAVE ON STACK
0F14 3005               0293        LEAX  5,X          POINT TO I(1)
0F16 17FF8B             0294        LBSR  GETNUM       D HAS SECOND PARAMETER
0F19 6F8DFF2C           0295        CLR   SORDER,PCR
0F1D 10A3E4             0296        CMPD  ,S           COMPARE 2ND W/ 1ST
0F20 240A               0297        BHS   ASCND        ASCENDING ORDER
0F22 6C8DFF23           0298        INC   SORDER,PCR   DESCENDING
0F26 3510               0299        PULS  X            GET 1ST PARAMETER IN X
0F28 1E10               0300        EXG   X,D          SWAP VALUES
0F2A 2002               0301        BRA   CALCRG       CALCULATE RANGE
0F2C 3510               0302 ASCND  PULS  X            GET 1ST PARAMETER
0F2E AF8DFECE           0303 CALCRG STX   BEGIN,PCR    SET BEGIN OF RANGE
0F32 ED8DFECC           0304        STD   ENDING,PCR   SET END OF RANGE
                        0305 *D HAS HIGHER PARAMETER
                        0306 * IS N =0?
0F36 10830000           0307        CMPD  #0
0F3A 2706               0308        BEQ   SIZBAD
                        0309 *IS IT >A895?
0F3C 10830FFF           0310        CMPD  #A895
0F40 2305               0311        BLS   NISOK
0F42 3262               0312 SIZBAD LEAS  2,S          CLEAN Y OFF STACK
0F44 C604               0313        LDB   #4           GET ERROR CODE
0F46 39                 0314        RTS
                        0315 ***
0F47 3510               0316 NISOK  PULS  X            GET VPTRI IN X
0F49 10AEE4             0317        LDY   ,S           GET ARRAY ELEMENT COUNT
0F4C 109C0003           0318        CMPY  #3
0F50 252E               0319        BLO   CALERR       MUST BE >=3
```


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```
0F52 2206      0320        BHI   GETDIM      THERE IS I(3) VALUE
0F54 6F8DFEEE  0321        CLR   DIMEN,PCR   SET FLAG
0F58 2014      0322        BRA   IVALS
               0323 **
0F5A 308F      0324 GETDIM LEAX  15,X        POINT TO I(3) VALUE
0F5C 17FF45    0325        LBSR  GETNUM      GET IT IN D
0F5F 1083 0003 0326        CMPD  #3
0F63 2305      0327        BLS   STRVAL      MUST BE 0 TO 3
0F65 3262      0328        LEAS  2,S         CLEAN STACK
0F67 C686      0329        LDB   #6
0F69 39        0330        RTS
               0331 **
0F6A E78DFED8  0332 STRVAL STB   DIMEN,PCR
0F6E 3520      0333 IVALS  PULS  Y           RESTORE I ELEMENT COUNT
0F70 6F8DFECD  0334        CLR   IFLAG,PCR   PRESET REGULAR SORT FLAG
0F74 108C0004  0335        CMPY  #4          TEST 1 DIMENSION
0F78 2709      0336        BEQ   ISIZOK
0F7A 6C8DFEC3  0337        INC   IFLAG,PCR   SET TO SPECIAL SORT
0F7E 2003      0338        BRA   ISIZOK
               0339 *MUST BE AT LEAST 3 ELEMENTS
0F80 C605      0340 CALERR LDB   #5          SET UP RETURN CODE
0F82 39        0341        RTS               AND RETURN
               0342 ****************************
               0343 *CHECK "A" ARRAY VALIDITY
0F83 AE8DFEBB  0344 ISIZOK LDX   VPTRA,PCR   POINT TO A ARRAY
0F87 8641      0345        LDA   #'A         SET FIRST LETTER OF NAME
0F89 170003    0346        LBSR  ARYCHK
0F8C 5D        0347        TSTB              OK IF ZERO
0F8D 2F03      0348        BLE   AOK
0F8F CB06      0349        ADDB  #6          ERROR CODE 7/8
0F91 39        0350        RTS               RETURN ERROR CODE
               0351 * RETURNED BY ARYCHK
               0352 *STORE ARRAY TYPE FROM A
0F92 A78DFEB1  0353 AOK    STA   SORTYP,PCR
               0354 *TEST ARRAY SIZE AGAINST N
               0355 *IN LAST DIMENSION
0F96 10AC8DFE67 0356       CMPY  ENDING,PCR
```


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```
0F9B 2203      0357        BHI   BIDIM       ARRAY IS SAME OR LARGER
0F9D C609      0358 NINERR LDB   #9            SET RETURN CODE
0F9F 39        0359        RTS               RETURN
               0360 ******************
0FA0 5D        0361 BIDIM  TSTB              0 IF UNIDIM,-1 OF BIDIM
0FA1 2738      0362        BEQ   CKDIMN
0FA3 AE8DFE9B  0363        LDX   VPTRA,PCR
0FA7 AE1C      0364        LDX   -4,X        GET 2ND DIM SIZE
0FA9 8C0002    0365        CMPX  #2          MUST BE TWO
0FAC 26EF      0366        BNE   NINERR
               0367 ****
0FAE 1F21      0368        TFR   Y,X
0FB0 1700E3    0369        LBSR  GETPTR      TO A(0,1)
               0370 * Y HAD ELEMENT COUNT IN FIRST DIM
               0371 *X NOW HAS ITS ADDRESS
0FB3 AF8DFE8D  0372        STX   ASLAVE,PCR  SET SLAVE POINTER
0FB7 E68DFE89  0373        LDB   DIMEN,PCR   MUST WE SWAP VPTRA & ASLAVE
0FBB C102      0374        CMPB  #2          NOT IF IT'S LESS THAN 2
0FBD 2525      0375        BLO   SIZOK
0FBF AE8DFE7F  0376        LDX   VPTRA,PCR
0FC3 10AE8DFE7C 0377       LDY   ASLAVE,PCR
0FC8 AF8DFE78  0378        STX   ASLAVE,PCR
0FCC 10AF8DFE71 0379       STY   VPTRA,PCR
0FD1 C102      0380        CMPB  #2          IF I(3)=2 DON'T SORT SLAVE ELEMENT
0FD3 260F      0381        BNE   SIZOK
0FD5 6F8DFE6D  0382        CLR   DIMEN,PCR   RESET SO APPEARS 1 DIMENSIONAL
0FD9 2009      0383        BRA   SIZOK
               0384 ****
               0385 *CHECK DIMEN IS ZERO IF UNIDIMENSIONAL
0FDB 6D8DFE67  0386 CKDIMN TST   DIMEN,PCR
0FDF 2703      0387        BEQ   SIZOK
0FE1 C60A      0388        LDB   #10
0FE3 39        0389        RTS
               0390 **********
               0391 * BOTH ARRAYS CHECK OUT
               0392 ************************
               0393 *SET UP STACK POINTER
               0394 *12 DEEP, 2 BYTES, LEFT & RIGHT POINTER
0FE4 338DFE55  0395 SIZOK  LEAU  STACK+(2*12*2),PCR
0FE8 EF8DFE51  0396        STU   NTPTR,PCR   TO DETECT WHEN STACK IS EMPTY
0FEC EC8DFE12  0397        LDD   ENDING,PCR  GET ITEM COUNT
0FF0 10A38DFE0B 0398       CMPD  BEGIN,PCR
               0399 * IF EQUAL   THEN NOTHING TO STACK
               0400 *ONLY 1 ELEMENT IN ARRAY
0FF5 270B      0401        BEQ   NOSTAK
               0402 *MORE THAN 1 ELEMENT SO PUSH LEFT THEN RIGHT
0FF7 AE8DFE05  0403        LDX   BEGIN,PCR   LEFT POINTER
0FFB 10AE8DFE02 0404       LDY   ENDING,PCR  GET RIGHT END
1000 3630      0405        PSHU  #PARTTN     AND STORE
               0406 ************************
               0407 *INITIALIZING COMPLETE

1002 5F        0408 NOSTAK CLRB              GOOD RETURN CODE
1003 39        0409        RTS
               0410 ************************
               0411 *
               0412 ***** DATAGT ******
               0413 *THIS GETS 2 VALUES FROM I ARRAY IF
               0414 *THEY EXIST, OTHERWISE SETS SCAN START TO 0, SCEND TO 0
               0415 *VALUES ARE REDUCED TO A ZERO BASE
               0416 *B=0 IF IT GOT AT LEAST ONE VALUE FROM ARRAY
               0417 *B=1 IF NONE FROM ARRAY
1004 3430      0418 DATAGT PSHS  X,Y         PRESERVE POINTERS
1006 8D1E      0419        BSR   NXTVAL
1008 270A      0420        BEQ   VALUES      B=0 SO MORE VALUES IN I
100A 6F8DFE3E  0421        CLR   SCSTRT,PCR  SCAN SRART=0
100E 6F8DFE3B  0422        CLR   SCEND,PCR   SCAN END =0
1012 200F      0423        BRA   RETRN       WITH B=1
               0424 ******************
1014 A78DFE34  0425 VALUES STA   SCSTRT,PCR  SET SCAN START
1018 8D0C      0426        BSR   NXTVAL      GET NEXT
101A 2703      0427        BEQ   GOTVAL      MORE VALUES
101C 86FF      0428        LDA   #255        SET TO MAX
101E 5F        0429        CLRB              DATA FLAG SET TO 0 FOR RETURN
101F A78DFE2A  0430 GOTVAL STA   SCEND,PCR
1023 3530      0431 RETRN  PULS  X,Y
1025 39        0432        RTS               WITH B
               0433 **********************
               0434 *GETS NEXT TWO VALUES FROM I ARRAY
               0435 *IF NO MORE THEN B IS RETURNED 1, ZERO ELSE
```

```
1026 10AE8DFE14 0436 NXTVAL LDY   VPTRI,PCR   POINT X TO I(0)
102B AE8DFE1B   0437        LDX   ICOUNT,PCR  GET CURENT SUBSCRIPT OF I
102F AC3E       0438        CMPX  -2,Y        ELEMENT COUNT IN HEADER
1031 2429       0439        BHS   NODATA      NO MORE DATA
1033 3001       0440        LEAX  1,X         INCREMENT ICOUNT
1035 AF8DFE11   0441        STX   ICOUNT,PCR  FOR NEXT TIME
1039 301F       0442        LEAX  -1,X        RETURN X TO ORIGINAL VALUE
103B 170061     0443        LBSR  MULT5       CALCULATE OFFSET
103E E38DFDFD   0444        ADDD  VPTRI,PCR   AND ACTUAL ADDRESS
1042 1F01       0445        TFR   D,X
1044 17FE5D     0446        LBSR  GETNUM      GET VALUE IN D
1047 10830000   0447        CMPD  #0          IF ZERO LEAVE AS IS
104B 270F       0448        BEQ   NODATA
104D B30001     0449        SUBD  #1          REDUCE TO ZERO BASE
1050 108300FF   0450        CMPD  #255        TOO HIGH?
1054 2302       0451        BLS   NTHIGH      NO IN RANGE
1056 C6FF       0452        LDB   #255        SET TO LIMIT
1058 1E89       0453 NTHIGH EXG   A,B
105A 5F         0454        CLRB              SET TO INDICATE MORE DATA
105B 39         0455        RTS
                0456 *****
105C C601       0457 NODATA LDB   #1          SET FLAG
105E 39         0458        RTS
                0459 *
                0460 ****************************
                0461 *SUBROUTINE TO CHECK ARRAY NAME
                0462 *FIRST LETTER OF ARRAY IS PASSED IN A REGISTER
                0463 *X CONTAINS POINTER TO ZERO ELEMENT
                0464 *A IS RETURNED:
                0465 *   1 OF A NUMBER ARRAY
                0466 *   0 IF A STRING
                0467 *B IS RETURNED:
                0468 *  -1 OF OK AND BIDIMENSIONAL
                0469 *   0 IF ALL OK
                0470 *   1 IF BAD NAME
                0471 *   2 IF BAD DIMENSION
                0472 *Y CONTAINS ARRAY ELEMENT COUNT
                0473 ****************************
                0474 *SEE IF SORT ARRAY IS NAMED OK
105F 3410       0475 ARYCHK PSHS  X           SAVE PTR TO A$(0)
1061 3019       0476        LEAX  -7,X        POINT TO NAME IF UNIDIM
1063 10AE05     0477        LDY   5,X         GET FIRST DIM ELEMENT COUNT IN Y
1066 A184       0478        CMPA  ,X          TEST NAME
1068 2711       0479        BEQ   NAMEOK
106A 301E       0480        LEAX  -2,X        NAME IF 2 DIMENSIONS
106C A184       0481        CMPA  ,X
106E 2708       0482        BEQ   NAMEOK
1070 301E       0483        LEAX  -2,X        NAME IF 3 DIMENSIONS
1072 A184       0484        CMPA  ,X
1074 2705       0485        BEQ   NAMEOK
1076 3262       0486        LEAS  2,S         CLEAN STACK
1078 C601       0487        LDB   #1          SET ERROR CODE
107A 39         0488        RTS               AND RETURN
                0489 ********************
107B 4F         0490 NAMEOK CLRA              SET TO STRING TYPE
107C E601       0491        LDB   1,X         GET NEXT LETTER
107E 2B01       0492        BMI   STRING      IT IS A STRING ARRAY
1080 4C         0493        INCA                SET FLAG TO 1 FOR NUMBER ARRAY
                0494 **CHECK DIMENSION
1081 E604       0495 STRING LDB   4,X         DIMENSION LOCATION
1083 C102       0496        CMPB  #2          IS IT BIDIMENSIONAL?
1085 2305       0497        BLS   DIMOK       NOT 3 OR MORE
1087 3262       0498        LEAS  2,S         CLEAN STACK
1089 C602       0499        LDB   #2          RETURN 2 IF SIZE IS WRONG
108B 39         0500        RTS
                0501 ********************
108C 2703       0502 DIMOK  BEQ   TWODIM       ITS BIDIMENSIONED
108E 5F         0503        CLRB              SET FLAG
108F 2002       0504        BRA   GONOUT       ALL DONE SO EXIT
1091 C6FF       0505 TWODIM LDB   #-1          SET BIDIM FLAG
                0506 ***
1093 3510       0507 GONOUT PULS  X           RECOVER POINTER
1095 39         0508        RTS
                0509 ********************
                0510 ********GETPTR********
                0511 *THIS RETURNS A POINTER TO A STRING DESCRIPTOR
                0512 *IN A$ OR THE NUMBER IN A*
                0513 *GIVEN THE SUBSCRIPT
                0514 *X CONTAINS SUBSCRIPT COMING IN
                0515 *AND POINTER TO 5 BYTE GROUP IN A$
```

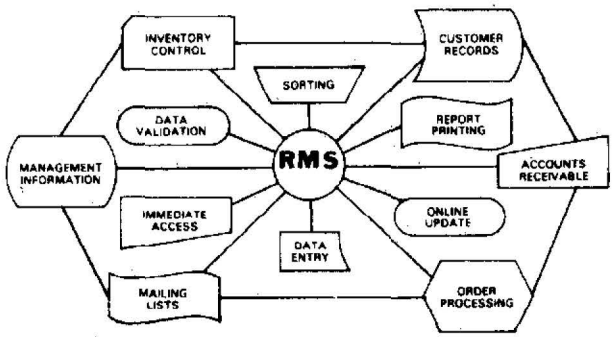

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```
                    0516 *OR A ON EXIT.
                    0517 *PROCEDURE: MULT5 MULTIPLIES X BY 5 ADDS VPTRA TO
                    0518 *RETURN DESCRIPTOR ADDRESS
                    0519 ***
1096 8D07           0520 GETPTR BSR   MULT5       GET DATA ADDRESS IN X
                    0521 *
1098 E3BDFDA6       0522        ADDD  VPTRA,PCR   ADD ADDRESS OF A$(0)
109C 1F01           0523        TFR   D,X         PUT INTO X FOR RETURN
109E 39             0524        RTS
                    0525 ************************
                    0526 * THIS MULTIPLIES A POINTER IN X BY 5
                    0527 *RETURN RESULT IN D
109F 3410           0528 MULT5  PSHS  X
10A1 1F10           0529        TFR   X,D
0004                0530        RPT   4
                    0531        ADDD  ,S          X ON STACK
                    0532        ENDR
10A3 E3E4               +       ADDD  ,S          X ON STACK
10A5 E3E4               +       ADDD  ,S          X ON STACK
10A7 E3E4               +       ADDD  ,S          X ON STACK
10A9 E3E4               +       ADDD  ,S          X ON STACK
10AB 3262           0533        LEAS  2,S         CLEAN STACK
10AD 39             0534        RTS
                    0535 *
                    0536 ****************************
10AE 11A38DFD8A 0537 UNSTCK CMPU  MTPTR,PCR   ANYTHING TO UNSTACK?
10B3 2602           0538        BNE   POPSTK      YES SO GET POINTERS
10B5 5F             0539        CLRB              FLAG FOR STACK EMPTY
10B6 39             0540        RTS
                    0541 ***
10B7 3730           0542 POPSTK PULU  #PARTTN     X HAS LEFT, Y RIGHT
10B9 AF8DFD43       0543        STX   BEGIN,PCR   SET SCAN BEGINNING
10BD AF8DFD43       0544        STX   LI,PCR      SET LEFT INDEX
10C1 10AF8DFD3C     0545        STY   ENDING,PCR  SET SCAN END
10C6 10AF8DFD3B     0546        STY   RI,PCR      SET RIGHT INDEX
10CB C601           0547        LDB   #1          SET FLAG TO SHOW POP
10CD 39             0548        RTS
                    0549 ****************************
                    0550 * SCANS FROM "LI" LOOKING FOR ITEM => THEN COMPARAND
```


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```
                    0551 *"LI" IS LEFT POINTING TO => ITEM
10CE AE8DFD32       0552 LSCAN  LDX   LI,PCR      PUT LI INTO X FOR GETPTR
10D2 318DFD32       0553        LEAY  CMPADD,PCR  GET COMPARAND ADDRESS
                    0554 * THIS WILL REMAIN GOOD FOR RSCAN
10D6 3410           0555 CONSCN PSHS  X           PRESERVE POINTER
10D8 17FFBB         0556        LBSR  GETPTR      RETURNS X POINTING TO 5 BYTE
                    0557 *                        DESCRIPTOR OF STRING OR NUMBER
                    0558 *NOW DO A COMPARE
10DB 17816F         0559        LBSR  COMPAR      RETURNS B=0 IF EQUAL,
                    0560 *                        1 IF ITEM > COMP
                    0561 *IF B IS -1 THEN ITEM IS <COMP
                    0562 *REVERSED IF ORDER IS DESCENDING
10DE 3510           0563        PULS  X           RECOVER POINTER
10E0 6F8DFD64       0564        CLR   CMEQ,PCR    CLEAR EQUALITY FLAG
10E4 5D             0565        TSTB              INSPECT RETURNED VALUE
10E5 2705           0566        BEQ   ISSAME      AS COMPARAND
10E7 6C8DFD5D       0567        INC   CMEQ,PCR    SET FLAG TO NOT ZERO
10EB 5D             0568        TSTB              RETEST B
10EC 2C04           0569 ISSAME BGE   GOTGE        GOT ONE => THAN
                    0570 *COMP. (OR =< FOR DESCENDING)
                    0571 *AS COMPARAND WAS CHOOSEN FROM THIS PARTITION,
                    0572 *A MATCH IS INEVITABLE
                    0573 ****
                    0574 * MOVE LI ONE RIGHT
10EE 3001           0575        LEAX  1,X         INCREMENT POINTER
10F0 20E4           0576        BRA   CONSCN      CONTINUE SCANNING
                    0577 **
10F2 AF8DFD0E       0578 GOTGE  STX   LI,PCR      SAVE NEW LI VALUE
10F6 39             0579        RTS               WITH LI POINTING TO => ITEM
                    0580 ****************************
                    0581 * SCANS FROM "RI" LOOKING FOR ITEM =< THEN COMPARAND
                    0582 *"RI" IS RIGHT POINTING TO =< ITEM
10F7 AE8DFD0B       0583 RSCAN  LDX   RI,PCR      PUT RI INTO X FOR GETPTR
10FB 3410           0584 DOSCAN PSHS  X           PRESERVE RI POINTER
10FD 17FF96         0585        LBSR  GETPTR      RETURNS X POINTING TO 5 BYTE
                    0586 *                        DESCRIPTOR OF STRING OR NUMBER
                    0587 *NOW DO A COMPARE
1100 17814A         0588        LBSR  COMPAR      RETURNS B=0 IF EQUAL,
                    0589 *                        1 IF ITEM > COMP
                    0590 *IF B IS -1 THEN ITEM IS <COMP
                    0591 *(REVERSED IF DESCENDING ORDER)
1103 3510           0592        PULS  X           RECOVER RI POINTER IN X
1105 5D             0593        TSTB              INSPECT RETURNED VALUE
1106 2705           0594        BEQ   ISSAM       AS COMPARAND
1108 6C8DFD3C       0595        INC   CMEQ,PCR    SET TO NOT ZERO
110C 5D             0596        TSTB              RETEST VALUE IN B
110D 2F04           0597 ISSAM  BLE   GOTLE        GOT ONE =< THAN COMP.
                    0598 *AS COMPARAND WAS CHOOSEN FROM THIS PARTITION,
                    0599 *A MATCH IS INEVITABLE
                    0600 ****
                    0601 * MOVE RI ONE LEFT
110F 301F           0602        LEAX  -1,X        REDUCE TI POINTER
1111 20E8           0603        BRA   DOSCAN      CONTINUE SCANNING
                    0604 **
1113 AF8DFCEF       0605 GOTLE  STX   RI,PCR      SAVE NEW RI VALUE
1117 39             0606        RTS               WITH RI POINTING TO =< ITEM
                    0607 ****************************
                    0608 * SWAP WILL EXCHANGE VALUES DESCRIPTORS
                    0609 *POINTED TO BY RI AND LI
                    0610 *THEN INCREASE LI AND DECREASE RI TO MOVE
                    0611 *PAST SWAPPED ITEMS
                    0612 *
1118 327B           0613 SWAP   LEAS  -5,S        TEMP STORAGE SPACE
111A 6D8DFD2A       0614        TST   CMEQ,PCR    CHK FOR EQUALITY TO COMPARAND
111E 2764           0615        BEQ   NOSWAP      EQUAL SO DONT SWAP
1120 AE8DFCE9       0616        LDX   LI,PCR
1124 17FF6F         0617        LBSR  GETPTR      GET ADDRESS OF DESCRIPTOR
1127 1F12           0618        TFR   X,Y         LI DESCRIPTOR ADDRESS
1129 AE8DFCD9       0619        LDX   RI,PCR      GET OTHER POINTER
112D 17FF66         0620        LBSR  GETPTR      GER ADDRESS
                    0621 *X NOW HAS ADDRESS OF RI DESCRIPTOR
                    0622        MOVE5 X,S          SWAP THE 2  STRING DESCIPTORS
1130 C604               +       LDB   #4          COUNTER
1132 A685               +.0000I LDA   B,X         GET BYTE
1134 A7E5               +       STA   B,S         MOVE IT
1136 5A                 +       DECB
1137 2AF9               +       BPL   .0000I      LOOP UNTIL B NEG
                    0623        MOVE5 Y,X         OR FP VALUES
1139 C604               +       LDB   #4          COUNTER
113B A6A5               +.0000Z LDA   B,Y         GET BYTE
```

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```
113D A785          +       STA   B,X         MOVE IT
113F 5A            +       DECB
1140 2AF9          +       BPL   .00002      LOOP UNTIL B NEG
                   0624    MOVES S,Y         USING STACK FOR TEMP STORAGE
1142 C604          +       LDB   #4          COUNTER
1144 A6E5          +.00003 LDA   B,S         GET BYTE
1146 A7A5          +       STA   B,Y         MOVE IT
1148 5A            +       DECB
1149 2AF9          +       BPL   .00003      LOOP UNTIL B NEG
114B 6D8DFCF7      0625    TST   DIMEN,PCR   IF ZERO LEAVE SLAVE DIM
114F 2733          0626    BEQ   NOSWAP
1151 1F18          0627    TFR   X,D         POINT X TO OTHER ARRAY ELEMENT
1153 A38DFCEB      0628    SUBD  VPTRA,PCR
1157 E38DFCE9      0629    ADDD  ASLAVE,PCR
115B 1F01          0630    TFR   D,X
115D 1F20          0631    TFR   Y,D         DO SAME FOR Y
115F A38DFCDF      0632    SUBD  VPTRA,PCR
1163 E38DFCDD      0633    ADDD  ASLAVE,PCR
1167 1F02          0634    TFR   D,Y
                   0635 *NOW SWAP 5 BYTES
                   0636    MOVES X,S
1169 C604          +       LDB   #4          COUNTER
116B A685          +.00004 LDA   B,X         GET BYTE
116D A7E5          +       STA   B,S         MOVE IT
116F 5A            +       DECB
1170 2AF9          +       BPL   .00004      LOOP UNTIL B NEG
                   0637    MOVES Y,X
1172 C604          +       LDB   #4          COUNTER
1174 A6A5          +.00005 LDA   B,Y         GET BYTE
1176 A785          +       STA   B,X         MOVE IT
1178 5A            +       DECB
1179 2AF9          +       BPL   .00005      LOOP UNTIL B NEG
                   0638    MOVES S,Y
117B C604          +       LDB   #4          COUNTER
117D A6E5          +.00006 LDA   B,S         GET BYTE
117F A7A5          +       STA   B,Y         MOVE IT
1181 5A            +       DECB
1182 2AF9          +       BPL   .00006      LOOP UNTIL B NEG
1184 AE8DFC7C      0639 NOSWAP LDX   LI,PCR  GET LI POINTER
1188 3091          0640    LEAX  1,X         AND ADD ONE
118A AF8DFC76      0641    STX   LI,PCR      AND SAVE IT
118E AE8DFC74      0642    LDX   RI,PCR      GET RI POINTER
1192 301F          0643    LEAX  -1,X        REDUCE RI
1194 AF8DFC6E      0644    STX   RI,PCR      AND SAVE IT
1198 3265          0645    LEAS  5,S         CLEAN STACK
119A 39            0646    RTS
                   0647 ****************************
                   0648 * THIS STACKS THE RIGHT PORTION OF THE PARTITION
                   0649 *AND PREPARES OTHER FOR SORTING
                   0650 *
119B AE8DFC67      0651 RGTSTK LDX   RI,PCR
119F 3091          0652        LEAX  1,X     LEFT END OF STACK PARTITION
11A1 ACBDFC5D      0653        CMPX  ENDING,PCR
11A5 2407          0654        BHS   DNTSTK
11A7 10AE8DFC56    0655        LDY   ENDING,PCR  GET RIGHT END
11AC 3630          0656        PSHU  #PARTTN     SAVE RIGHT PARTITION
                   0657 *SET UP BEGIN, ENDING,LI AND RI
11AE EC8DFC52      0658 DNTSTK LDD   LI,PCR      GET LEFT POINTER
11B2 830001        0659        SUBD  #1          DECREASE BY ONE
11B5 ED8DFC49      0660        STD   ENDING,PCR
11B9 ED8DFC49      0661        STD   RI,PCR
11BD EC8DFC3F      0662        LDD   BEGIN,PCR
11C1 ED8DFC3F      0663        STD   LI,PCR
11C5 39            0664        RTS
                   0665 ****************************
                   0666 * THIS STACKS THE LEFT PORTION OF THE PARTITION
                   0667 *AND PREPARES OTHER FOR SORTING
                   0668 *
11C6 10AE8DFC39    0669 LFTSTK LDY   LI,PCR
11CB 313F          0670        LEAY  -1,Y        RIGHT END OF STACK PARTITION
11CD 10AC8DFC2E    0671        CMPY  BEGIN,PCR
11D2 2306          0672        BLS   NOTSTK
11D4 AE8DFC28      0673        LDX   BEGIN,PCR   GET LEFT END
11D8 3630          0674        PSHU  #PARTTN     SAVE RIGHT PARTITION
                   0675 *SET UP BEGIN, ENDING,LI AND RI
11DA EC8DFC28      0676 NOTSTK LDD   RI,PCR      GET RIGHT POINTER
11DE C30001        0677        ADDD  #1          INCREASE BY ONE
11E1 ED8DFC18      0678        STD   BEGIN,PCR
11E5 ED8DFC18      0679        STD   LI,PCR
```

```
11E9 EC8DFC15   0680        LDD   ENDING,PCR
11ED ED8DFC15   0681        STD   RI,PCR
11F1 39         0682        RTS
                0683 ****************************
                0684 *PARTSZ COMPARES LEFT AND RIGHT PARTITIONS
                0685 *LEFT PARTITION IS FROM BEGIN TO LI
                0686 *RIGHT PARTITION IS FROM RI TO ENDING
11F2 EC8DFC0C   0687 PARTSZ LDD   ENDING,PCR
11F6 A38DFC0C   0688        SUBD  RI,PCR
                0689 *  D NOW HAS RIGHT PARTITION SIZE
11FA 3406       0690        PSHS  D               SAVE IT
11FC EC8DFC04   0691        LDD   LI,PCR
1200 A38DFBFC   0692        SUBD  BEGIN,PCR
                0693 *D NOW HAS LEFT PARTITION SIZE
1204 10A3E4     0694        CMPD  ,S              TEMP ON STACK CARRY WILL BE SET IF LEFT>=RIGHT
1207 3262       0695        LEAS  2,S             CLEAN STACK
1209 39         0696        RTS
                0697 ****** RNDCMP ********
                0698 *PUTS INTO CMPADD A 5 BIT DESCRIPTOR
                0699 *OF A RANDOM ELEMENT IN THE RANGE BEGIN-ENDING.
                0700 *SUBSCRIPT IS SELECTED BY RND
                0701 *THEN GETPTR GETS POINTER TO ITEM IN A($).
                0702 *THIS VALUE IS THEN MOVED TO CMPADD
                0703 ****************************
120A BD13       0704 RNDCMP BSR   RANDOM
                0705 *D CONTAINS # IN RANGE BEGIN-ENDING
120C 1F01       0706        TFR   D,X             FOR GETPTR
120E 17FE85     0707        LBSR  GETPTR
                0708 *X NOW POINTS TO ELEMENT IN ARRAY
                0709 *X CONTAINS THE ADDRESS OF THE 5 BYTE DESCRIPTER
                0710 *POINT Y TO CMPADD
1211 318DFBF3   0711        LEAY  CMPADD,PCR
                0712 *NOW MOVE 5 BYTES
                0713        MOVES X,Y
1215 C604       0714+       LDB   #4              COUNTER
1217 A685       0715+.00007 LDA   B,X             GET BYTE
1219 A7A5       0716+       STA   B,Y             MOVE IT
121B 5A         0717+       DECB
121C 2AF9       0718+       BPL   .00007          LOOP UNTIL B NEG
                0719 ** ALL DONE SO RETURN
121E 39         0720        RTS
                0721 ****************************
                0722 *** THIS RETURNS A RANDOM NUMBER BETWEEN BEGIN
                0723 *** AND ENDING INCLUSIVE.
                0724 *** VALUE IS RETURNED IN REG D.
                0725 *** BASICS RANDOM ROUTINE IS USED BY LOADING THE
                0726 *** RANGE IN THE FAC AND EXTRACTING
                0727 *** THE VALUE WITH INTCNV
                0728 ****************************
                0729 *CALCULATE RANGE
121F EC8DFBDF   0730 RANDOM LDD   ENDING,PCR
1223 A38DFBD9   0731        SUBD  BEGIN,PCR
1227 C30001     0732        ADDD  #1              MAKE ACTUAL COUNT
                0733 *POINT X AT FAC
122A BE004F     0734        LDX   #FAC
122D 17FCBF     0735        LBSR  INTRL           MAKE IT REAL AS  IN MEMORY
                0736 * FIX FOR FAC FORMAT
1230 A601       0737        LDA   1,X             GET 2ND BYTE
1232 A705       0738        STA   5,X             STORE IN 6TH
1234 8A8B       0739        ORA   #%10000000      SET BIT 7 TO 1
1236 A701       0740        STA   1,X             PUT IT BACK
                0741 *       NOW CALL RANDOM ROUTINE
1238 3440       0742        PSHS  U               PRESERVE PARTN POINTER
123A BDBF1F     0743        JSR   RND
                0744 * GET VALUE IN D WITH INTCNV
123D BE004F     0745        LDX   #FAC            ENSURE X POINTING AT FAC
1240 BDB3ED     0746        JSR   INTCNV
1243 3540       0747        PULS  U               RECOVER POINTER
                0748 *RANDOM NUMBER IN RANGE IS NOW IN D
1245 830001     0749        SUBD  #1              REDUCE TO ZERO BASE
1248 E38DFBB4   0750        ADDD  BEGIN,PCR       ADD OFFSET
                0751 * RESULT IS IN D
124C 39         0752        RTS
                0753 *
                0754 ****************************
                0755 *
                0756 ***** COMPARE *********
                0757 *ENTRY: X POINTS TO 5 BYTE STRING
                0758 *DESCRIPTOR OF ITEM
                0759 * Y TO 5 BYTE DESCRIPTOR OF COMPARAND
                0760 * SORTYP IS 0 FOR STRING COMPARE 1 FOR NUMBER
                0761 *
                0762 *EXIT:
                0763 *          SORDER=0       SORDER=1
                0764 * B = -1 IF ITEM < COMP. / ITEM> COMP.
                0765 * B = 0 IF ITEM = COMP.  / ITEM  = COMP.
                0766 * B= 1 IF ITEM > COMP./  ITEM < COMP.
                0767 ****************************
                0768 *  SEE IF STRING OR NUMBER COMPARE
                0769 *BY CHECKING SORTYP
124D 6D8DFBF6   0770 COMPAR TST   SORTYP,PCR
1251 2704       0771        BEQ   STRG
                0772 *ITS A NUMBER COMPARE
1253 8D39       0773        BSR   CMPNUM
1255 202F       0774        BRA   ORDCHK          CHECK ORDER OF SORT
                0775 *********
1257 6D8DFBE6   0776 STRG   TST   IFLAG,PCR       SPECIAL OR REGULAR SORT
1258 270D       0777        BEQ   REGLR           REGULAR
125D CC0004     0778        LDD   #4              PRESET ICOUNT TO
1260 ED8DFBE6   0779        STD   ICOUNT,PCR      SKIP FIRST 2 ELEMENTS
1264 17FD9D     0780        LBSR  DATAGT          GET FIRST VALUES FROM ARRAY
1267 5D         0781        TSTB
1268 270A       0782        BEQ   STRCMP
                0783 *GOT HERE BECAUSE B=1 AS NO DATA IN ARRAY
                0784 *SCSTRT & SCEND ARE BOTH 0 SO SET
                0785 *SCEND TO 255
126A 6F8DFBDE   0786 REGLR  CLR   SCSTRT,PCR
126E B6FF       0787        LDA   #255
1270 A78DFBD9   0788        STA   SCEND,PCR
1274 1700A1     0789 STRCMP LBSR  CMPSTR
1277 260D       0790        BNE   ORDCHK          B<>0 SO STRINGS NOT EQUAL
                0791 *THEREFORE CHECK NO FURTHER
                0792 *IF REGULAR SORT WE'RE DONE
1279 E68DFBC4   0793        LDB   IFLAG,PCR
127D 2707       0794        BEQ   ORDCHK
127F 17FD82     0795        LBSR  DATAGT          GET NEXT VALUES
                0796 *FOR STRING COMPARE RANGE
```


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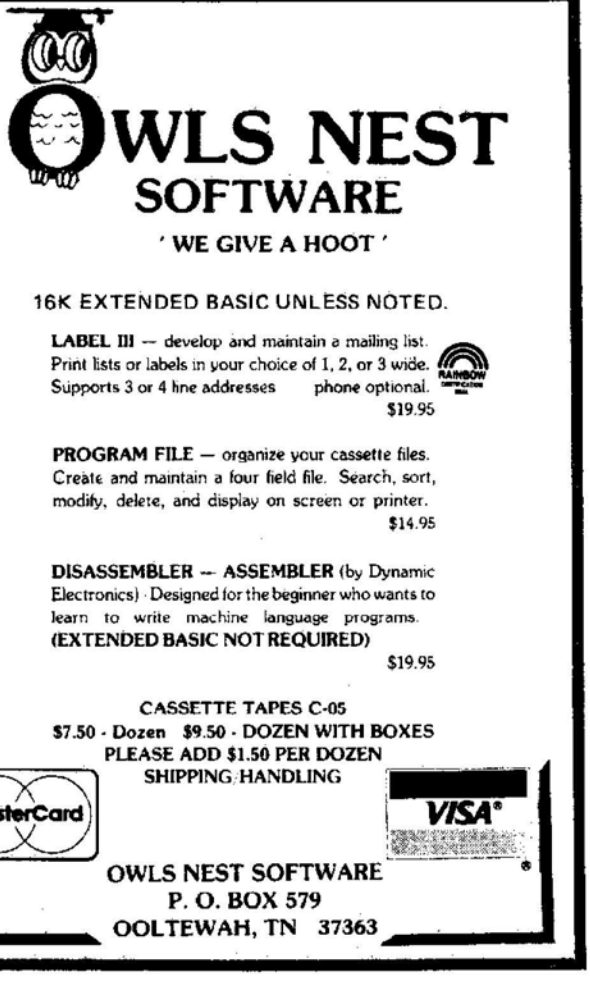
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```
                    0792 *B COMES BACK=0 IF DATA AVAILABLE
1282 5D             0793         TSTB
1283 27EF           0794         BEQ   STRCMP       COMPARE NEXT RANGE
1285 5F             0795         CLRB               AS STRINGS ARE EQUAL
                    0796 ************
1286 6D8DFBBF       0797 ORDCHK TST   SORDER,PCR
128A 27#1           0798         BEQ   COMEXT
128C 50             0799         NEGB               REVERSE POLARITY
128D 39             0800 COMEXT RTS
                    0801 ****************************
                    0802 ***** CMPNUM *******
                    0803 ** COMPARES 2 FLOATING POINT NUMBERS
                    0804 ** "A" POINTED TO BY X
                    0805 ** "B" POINTED TO BY Y
                    0806 *REG B RETURNED AS FOLLOWS:
                    0807 *    A=B    REG B =0
                    0808 *    A>B    REG B =1
                    0809 *    A<B    REG B =-1
                    0810 ******************************
                    0811 * FIRST SEE IF BOTH ARE ZERO
128E 327D           0812 CMPNUM LEAS  -3,S         MAKE ROOM FOR
                    0813 *SIGN FLAG AND TEMP STORAGE
129# 6FE4           0814         CLR   ,S           CLEAR SIGN FLAG
                    0815 *ON THE STACK
1292 6D84           0816         TST   ,X           EXPONENT
1294 26#B           0817         BNE   ANOT#
1296 6DA4           0818         TST   ,Y
1298 2614           0819         BNE   BNOT#
129A 5F             0820         CLRB               BOTH ZERO
129B 3263           0821 LEAVE   LEAS  3,S          REMOVE SIGN FLAG & TEMP STORE
129D 39             0822         RTS
                    0823 *******
                    0824 *A IS NOT ZERO
129E 6DA4           0825 ANOT#  TST   ,Y           EXPONENT B
12A# 2612           0826         BNE   ABNOT#       NEITHER ARE ZERO
12A2 6D#1           0827         TST   1,X          LOOK AT SIGN OF A
12A4 2A#4           0828         BPL   BPOSTV
12A6 C6FF           0829 BMINUS LDB   #-1
12A8 20F1           0830         BRA   LEAVE
```


```
                    0831 ******
12AA C6#1           0832 BPOSTV LDB   #1
12AC 20ED           0833         BRA   LEAVE
                    0834 ******
                    0835 * A IS ZERO B IS NOT
12AE 6D21           0836 BNOT#  TST   1,Y          LOOK AT SIGN OF B
12B# 2AF4           0837         BPL   BMINUS
12B2 20F6           0838         BRA   BPOSTV
                    0839 ****************************
                    0840 *NEITHER A NOR B ARE ZERO
12B4 6D#1           0841 ABNOT# TST   1,X          IS A NEG?
12B6 2A##           0842         BPL   APOS
                    0843 *A IS NEGATIVE IS B?
12B# 6D21           0844         TST   1,Y
12BA 2AEA           0845         BPL   BMINUS
                    0846 *B IS NEGATIVE SO BOTH ARE
12BC 63E4           0847         COM   ,S           SIGN FLAG SET
12BE 2#04           0848         BRA   EXPCHK       NOW CHECK EXPONENTS
                    0849 ************************
                    0850 *A IS POSITIVE
12C# 6D21           0851 APOS   TST   1,Y          IS B NEG?
12C2 2BE6           0852         BMI   BPOSTV
                    0853 *BOTH POSITIVE SO LEAVE SFALG CLEAR
                    0854 ************************
                    0855 *NOW CHECK EXPONENTS.
                    0856 * DONT FORGET SIGN IS REVERSED
12C4 6D84           0857 EXPCHK TST   ,X           A EXPONENT NEG
12C6 2A16           0858         BPL   AEXPNG       BRANCHES IF NEG
                    0859 *A EXPONENT IS POSITIVE
12C8 6DA4           0860         TST   ,Y           B EXPONENT NEG
12CA 2A3C           0861         BPL   BPOSCK       BRANCH OF NEGATIVE
                    0862 *A AND B EXP ARE POSITIVE
                    0863 *LOAD AND COMPARE
12CC E6A4           0864         LDB   ,Y           GET B IN ACC
12CE C47F           0865         ANDB  #%01111111   REMOVE SIGN BIT
12D# E761           0866         STB   1,S          ON STACK
12D2 E684           0867         LDB   ,X           GET A IN ACC
12D4 C47F           0868         ANDB  #%01111111
12D6 E161           0869 EXPCMP CMPB  1,S          ON STACK
12D8 2E2E           0870         BGT   BPOSCK       A>B
12DA 2D3#           0871         BLT   BNEGCK       A<B
                    0872 *EXPONENTS ARE THE SAME
12DC 20#C           0873         BRA   EXPEQL
                    0874 ****************************
                    0875 *A EXPONENT IS NEGATIVE
12DE 6DA4           0876 AEXPNG TST   ,Y           TEST B EXPONENT
12E# 2B2A           0877         BMI   BNEGCK       BRANCH IF POSITIVE
12E2 E684           0878         LDB   ,X           GET A EXPONENT
12E4 E761           0879         STB   1,S          TEMP VALUE ON STACK
12E6 E6A4           0880         LDB   ,Y           GET B EXPONENT
12E8 20EC           0881         BRA   EXPCMP
                    0882 *EXPONENTS ARE REVERSED IN A AND B SO SAME CHECK
                    0883 *CAN BE DONE
                    0884 ************************
                    0885 *EXPONENTS ARE EQUAL SO COMPARE MANTISSA
                    0886 *REMEMBER MS BYTE HAS A SIGN BIT
12EA EC21           0887 EXPEQL LDD   1,Y          MSB OF B AS 16 BITS
12EC 847F           0888         ANDA  #%01111111   REMOVE SIGN BIT
12EE ED61           0889         STD   1,S          SAVE ON STACK
12F# EC01           0890         LDD   1,X          GET MSB OF A AS 16 BITS
12F2 847F           0891         ANDA  #%01111111   REMOVE SIGN
12F4 10A361         0892         CMPD  1,S          VALUE ON STACK
12F7 2E0F           0893         BGT   BPOSCK       A>B
12F9 2D11           0894         BLT   BNEGCK       A<B
                    0895 *THESE ARE EQUAL DO NEXT
12FB EC03           0896         LDD   3,X          GET LAST 2 BYTES OF B
12FD 10A323         0897         CMPD  3,Y          COMPARE WITH THAT OF B
13## 2E06           0898         BGT   BPOSCK       A>B
1302 2D08           0899         BLT   BNEGCK       A<B
                    0900 *BOTH NUMBERS ARE SAME
1304 5F             0901         CLRB
1305 16FF93         0902         LBRA  LEAVE
                    0903 ****************************
1308 C6#1           0904 BPOSCK LDB   #1
130A 2002           0905         BRA   SGNCHK
130C C6FF           0906 BNEGCK LDB   #-1
130E 6DE4           0907 SGNCHK TST   ,S           SIGN FLAG
1310 10#7FF87       0908         LBEQ  LEAVE
1314 50             0909         NEGB
```

```
1315 16FF83    #910       LBRA  LEAVE
               #911 ***************************
               #912 ****** CMPSTR  *******
               #913 * COMPARES 2 STRINGS A$ AND B$
               #914 * REGISTER B RETURN RESULT AS FOLLOWS:
               #915 *
               #916 *   A$>B$    REG B=1
               #917 *   A$<B$        B=-1
               #918 *   A$=B$        B=0
               #919 ******************************
               #920 *   REG X POINTS TO DECRIPTOR OF A$
               #921 *   REG Y TO THAT OF B$
               #922 ******************************
131B 3438      #923 CMPSTR PSHS  X,Y         PRESERVE POINTERS
               #924 *REVISE STRING LENGTH BASED ON
               #925 *SCSTRT AND SCEND
131A A68DFB2F  #926        LDA   SCEND,PCR
131E A18DFB2A  #927        CMPA  SCSTRT,PCR  ARE POINTERS CROSSED?
1322 2558      #928        BLO   BZERO       NO STRING IF SO
1324 1F89      #929        TFR   A,B         SET UP B FOR LATER
1326 A184      #930        CMPA  ,X          SCEND WITH STRING LENGTH
1328 2404      #931        BHS   CUT         STRING SHORTER THAN SELECTED RANGE
132A 8B01      #932        ADDA  #1          ADJUST TO 1 BASE
132C 2002      #933        BRA   RNGADJ      FIX START POINT
132E A684      #934 CUT    LDA   ,X          GET STR LNGTH FROM HEADER
1330 A88DFB1B  #935 RNGADJ SUBA  SCSTRT,PCR  REMOVE START POINTER
1334 2401      #936        BHS   GTZERO      RANGE > ZERO
1336 4F        #937        CLRA              SET RANGE TO ZERO
1337 E1A4      #938 GTZERO CMPB  ,Y          SCEND WITH LENGTH OF B
1339 2404      #939        BHS   READJ       TOO LONG
133B CB01      #940        ADDB  #1          SET TO 1 BASE
133D 2002      #941        BRA   ADJRNG      REMOVE START POINTER
133F E6A4      #942 READJ  LDB   ,Y          GET B COUNT FROM HEADER
1341 E08DFB07  #943 ADJRNG SUBB  SCSTRT,PCR  REMOVE START POINTER
1345 2401      #944        BHS   SETADD      RANGE >=0
1347 5F        #945        CLRB              SET RANGE TO ZERO
1348 3406      #946 SETADD PSHS  A,B         ONTO STACK
               #947 * B IS AT 1,S , A IS AT 0,S
               #948 * NOW GET ADDRESS OF EACH STRING
               #949 *INTO X AND Y
134A 4F        #950        CLRA
134B E68DFAFD  #951        LDB   SCSTRT,PCR  LOAD START OFFSET
134F E302      #952        ADDD  2,X
1351 1F01      #953        TFR   D,X
1353 4F        #954        CLRA
1354 E68DFAF4  #955        LDB   SCSTRT,PCR
1358 E322      #956        ADDD  2,Y
135A 1F02      #957        TFR   D,Y
               #958 *
               #959 *START COMPARISON LOOP
135C 6DE4      #960 COMLOP TST   ,S          ANY MORE CHARACTERS IN A?
135E 271B      #961        BEQ   AEMPTY      NO SO BRANCH
               #962 *MORE LEFT IN A$
1360 6D61      #963        TST   1,S         ANY LEFT IN B$?
1362 2713      #964        BEQ   B1          NO SO A$>B$
               #965 *MORE IN B$ TOO SO COMPARE NEXT CHARACTER
1364 6AE4      #966        DEC   ,S          DECREASE COUNT OF A$
1366 6A61      #967        DEC   1,S         DECREASE COUNT OF B$
1368 A680      #968        LDA   ,X+         GET NEXT CHARACTER AND
               #969 *INCREMENT X
136A A1A0      #970        CMPA  ,Y+         COMPARE WITH NEXT IN B$
136C 27EE      #971        BEQ   COMLOP      SAME
136E 2207      #972        BHI   B1
1370 C6FF      #973 BMIN1  LDB   #-1
1372 3262      #974 FINSH  LEAS  2,S         CLEAN UP STACK
1374 3530      #975        PULS  X,Y         RECOVER POINTERS
1376 39        #976        RTS
1377 C601      #977 B1     LDB   #1
1379 20F7      #978        BRA   FINSH
               #979 *****
137B 6D61      #980 AEMPTY TST   1,S         IS B EMPTY
137D 26F1      #981        BNE   BMIN1       NO SO A$<B$
               #982 *YES SO A$=B$
137F 5F        #983 BZERO  CLRB
1380 20F0      #984        BRA   FINSH
               #985 ******************************
               #986 ***** EASISORT  **********
               #987 * SORTS ITEMS BETWEEN BEGIN & ENDING
               #988 *INCLUSIVE USING A FASTER ROUTINE FOR
               #989 *SMALL GROUPS
               #990 **********
1382 3440      #991 EZSORT PSHS  U           PRESERVE STACK PTR
1384 327B      #992        LEAS  -5,S        TEMP STORAGE
1386 1F43      #993        TFR   S,U         POINT U TO IT
1388 AE8DFA74  #994        LDX   BEGIN,PCR   LEFT SUBSCRIPT
138C 3410      #995        PSHS  X           ONTO STACK
138E AEE4      #996 UPSCAN LDX   ,S          GET VARIABLE "K"
1390 3001      #997        LEAX  1,X         INCREMENT K
1392 AFE4      #998        STX   ,S          AND SAVE IT
1394 AC8DFA6A  #999        CMPX  ENDING,PCR  ARE WE AT END?
1398 2305      1000        BLS   NOTEND
139A 3267      1001        LEAS  7,S         CLEAN STACK
139C 3540      1002        PULS  U           RECOVER STACK POINTER
139E 39        1003        RTS               AND RETURN
               1004 ********************
139F 17FCF4    1005 NOTEND LBSR  GETPTR      ADDRESS OF A$(K) IN X
13A2 1F12      1006        TFR   X,Y         MOVE TO Y
13A4 313B      1007        LEAY  -5,Y        POINT Y AT A$(K-1)
13A6 3410      1008        PSHS  X           PRESERVE A$(K) ADDRESS
13A8 17FEA2    1009        LBSR  COMPAR      DO A COMPARE
13AB 3510      1010        PULS  X           RECOVER A$(K) ADDRESS
13AD 5D        1011        TSTB              LOOK COMPARE RESULT
13AE 2ADE      1012        BPL   UPSCAN      A$(K)>=A$(K-1)
13B0 318DFA54  1013        LEAY  CMPADD,PCR  POINT Y AT COMADD
               1014        MOVE5 X,Y         PUT A$(K) IN TEMP
13B4 C604          +       LDB   #4          COUNTER
13B6 A685          +.00008 LDA   B,X         GET BYTE
13B8 A7A5          +       STA   B,Y         MOVE IT
13BA 5A            +       DECB
13BB 2AF9          +       BPL   .00008      LOOP UNTIL B NEG
13BD 6D8DFA85  1015        TST   DIMEN,PCR
13C1 2719      1016        BEQ   SHFT        DONT SWAP SLAVE
13C3 3410      1017        PSHS  X           SAVE A$(K) PTR
13C5 1F10      1018        TFR   X,D
13C7 A38DFA77  1019        SUBD  VPTRA,PCR   POINT TO
13CB E38DFA75  1020        ADDD  ASLAVE,PCR  SALVE ELEMENT
13CF 1F01      1021        TFR   D,X
```


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```
                    1022        MOVE5 X,U          SAVE TEMPORARILY
13D1 C604                 +     LDB   #4           COUNTER
13D3 A685                 +.00009 LDA   B,X        GET BYTE
13D5 A7C5                 +     STA   B,U          MOVE IT
13D7 5A                   +     DECB
13D8 2AF9                 +     BPL   .00009       LOOP UNTIL B NEG
13DA 3510           1023        PULS  X            RECOVER PTR
                    1024 * X HAS ADDRESS OF A$(J)
13DC 1F12           1025 SHFT   TFR   X,Y          POINT Y @ A$(J)
13DE 3018           1026        LEAX  -5,X         POINT X @ A$(J-1)
                    1027 *AND REDUCE FOR NEXT PASS
                    1028        MOVE5 X,Y          A$(J)=A$(J-1)
13E0 C604                 +     LDB   #4           COUNTER
13E2 A685                 +.00010 LDA   B,X        GET BYTE
13E4 A7A5                 +     STA   B,Y          MOVE IT
13E6 5A                   +     DECB
13E7 2AF9                 +     BPL   .00010       LOOP UNTIL B NEG
13E9 3410           1029        PSHS  X            SAVE A$(J) ADDRESS
13EB 6D8DFA57       1030        TST   DIMEN,PCR    IF ZERO DONT DO
13EF 2721           1031        BEQ   NXSHFT       SLAVE SWAP
13F1 1F10           1032        TFR   X,D
13F3 A38DFA4B       1033        SUBD  VPTRA,PCR
13F7 E38DFA49       1034        ADDD  ASLAVE,PCR
13FB 1F01           1035        TFR   D,X
13FD 1F20           1036        TFR   Y,D
13FF A38DFA3F       1037        SUBD  VPTRA,PCR
1403 E38DFA3D       1038        ADDD  ASLAVE,PCR
1407 1F02           1039        TFR   D,Y
                    1040        MOVE5 X,Y
1409 C604                 +     LDB   #4           COUNTER
140B A685                 +.00011 LDA   B,X        GET BYTE
140D A7A5                 +     STA   B,Y          MOVE IT
140F 5A                   +     DECB
1410 2AF9                 +     BPL   .00011       LOOP UNTIL B NEG
1412 AE8DF9EA       1041 NXSHFT LDX   BEGIN,PCR    GET BEGIN SUBSCRIPT
1416 17FC7D         1042        LBSR  GETPTR       GET ITS ADDRESS
1419 ACE4           1043        CMPX  ,S           COMPARE WITH A$(J) ADDRESS
141B 2712           1044        BEQ   SLOTIN       AT START OF PARTITION
141D AEE4           1045        LDX   ,S           RECOVER A$(J) BUT LEAVE ON STACK
141F 3018           1046        LEAX  -5,X         MOVE TO A$(J-1)
1421 318DF9E3       1047        LEAY  CMPADD,PCR   POINT Y @ COMADD
1425 17FE25         1048        LBSR  COMPAR       COMPARE A$(J-1) WITH TEMP
1428 5D             1049        TSTB               LOOK AT RESULT
1429 2B04           1050        BMI   SLOTIN       FOUND RIGHT SLOT
142B 3510           1051        PULS  X            RECOVER A$(J) ADDRESS
142D 20AD           1052        BRA   SHFT         CONTINUE SHIFTING UP
                    1053 *******
142F 3510           1054 SLOTIN PULS  X            RECOVER A$(J) ADDRESS
1431 318DF9D3       1055        LEAY  CMPADD,PCR   POINT Y @ COMADD
                    1056        MOVE5 Y,X          A$(J)=TEMP
1435 C604                 +     LDB   #4           COUNTER
1437 A6A5                 +.00012 LDA   B,Y        GET BYTE
1439 A785                 +     STA   B,X          MOVE IT
143B 5A                   +     DECB
143C 2AF9                 +     BPL   .00012       LOOP UNTIL B NEG
143E 6D8DFA84       1057        TST   DIMEN,PCR    DONT DO IT OF ITS 0
1442 1027FF48       1058        LBEQ  UPSCAN
1446 1F10           1059        TFR   X,D
1448 A38DF9F6       1060        SUBD  VPTRA,PCR
144C E38DF9F4       1061        ADDD  ASLAVE,PCR
1450 1F01           1062        TFR   D,X
                    1063        MOVE5 U,X          SET TEMP INTO ARRAY
1452 C604                 +     LDB   #4           COUNTER
1454 A6C5                 +.00013 LDA   B,U        GET BYTE
1456 A785                 +     STA   B,X          MOVE IT
1458 5A                   +     DECB
1459 2AF9                 +     BPL   .00013       LOOP UNTIL B NEG
145B 16FF38         1064        LBRA  UPSCAN
                    1065 ************************
                    1066        NAM   QSORT
                    1067        TTL   QUICKSORT BY COLIN J. STEARMAN
0E4E                1068        END   QSORT
          NO ERROR(S) DETECTED
```

SYMBOL TABLE:

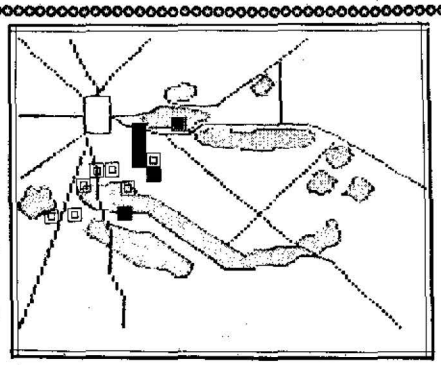
```
.00000 0EAA     .00001 1132     .00002 113B     .00003 1144
.00004 1168     .00005 1174     .00006 117D     .00007 1217
.00008 13B6     .00009 13D3     .00010 13E2     .00011 1408
.00012 1437     .00013 1454     ABNOT0 12B4     ADJRNG 1341
AEMPTY 1370     AEXPNG 12DE     AGAIN  0ECC     ANOT0  129E
ADK    0F92     APOS   12C0     ARYCHK 105F     ASCND  0F2C
ASLAVE 0E44     B1     1377     BASIC  B4F4     BEGIN  0E00
BIDIM  0FA0     BMINI  1370     BMINUS 12A6     BNEGCK 138C
BNOT0  12AE     BPOSCK 1308     BPOSTV 12AA     BZERO  137F
CALCRG 0F2E     CALERR 0F80     CALLOK 0E5C     CHKTYP 0F04
CKDIMN 0FDB     CKSIZE 0E62     CMEQ   0E48     CMPADD 0E08
CMPNUM 128E     CMPSTR 1318     COMEXT 128D     COMLOP 135C
COMPAR 124D     CONSCN 10D6     CROSS  0EB5     CUT    132E
DATAGT 1004     DIMEN  0E46     DIMOK  108C     DNTSTK 11AE
DOSCAN 10FB     ENDING 0E02     EXIT   0E56     EXPCHK 12C4
EXPCMP 12D6     EXPEQL 12EA     EZSORT 1382     EZSRT  0E9F
FAC    004F     FINSH  1372     GETDIM 0F5A     GETNUM 0EA4
GETPTR 1096     GONOUT 1093     GOTERR 0F03     GOTGE  10F2
GOTLE  1113     GOTVAL 101F     GTZERO 1337     ICOUNT 0E4A
IFLAG  0E41     IISNUM 0F08     INIT   0EE1     INTCNV B3ED
INTRL  0EBF     ISIZOK 0F83     ISSAM  110D     ISSAME 10EC
IVALS  0F6E     LEAVE  129B     LFTSTK 11C6     LI     0E04
LSCAN  10CE     MOVE5  MACRO    MTPTR  0E3D     MULT5  109F
NAMEOK 107B     NINERR 0F9D     NISOK  0F47     NODATA 105C
NOSTAK 1002     NOSWAP 1184     NOTEND 139F     NOTSTK 11DA
NTHIGH 1058     NTZERO 0ECB     NXSHFT 1412     NXTPRT 0E92
NXTVAL 1026     ORDCHK 1286     PARTSZ 11F2     PARTTN 0030
POPSTK 1007     QSORT  0E4E     RANDOM 121F     READJ  133F
REGLR  126A     RETRN  1023     RGTSTK 119B     RI     0E06
RIGHT  0E8F     RND    BF1F     RNDCMP 120A     RNGADJ 1330
RSCAN  10F7     SCAN   0E71     SCEND  0E4D     SCSTRT 0E4C
SETADD 1348     SGNCHK 130E     SHFT   13DC     SIZBAD 0F42
SIZOK  0FE4     SLOTIN 142F     SORDER 0E49     SORTYP 0E47
STACK  0E0D     STRCMP 1274     STRG   1257     STRING 1001
STRVAL 0F6A     SWAP   1118     TWODIM 1091     UNSTCK 10AE
UPSCAN 138E     VALUES 1014     VPTRA  0E42     VPTRI  0E3F
WARG   0002
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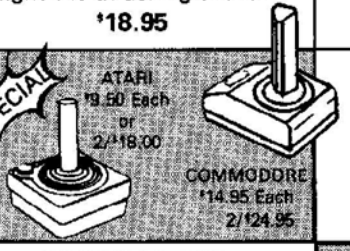
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Missile Barrage



Well, there I was, nervous before I even began. I anxiously pressed *CLOAD* and *ENTER* and there before my eyes was a mountainous war field with my opponent shielded in the mountain range. I entered my coordinates — "Meet your destiny, moose breath!"

If you'd like to set your sites on an exciting game of skill and combat, then head for the hills, put on your battle helmets and get ready for *Missile Barrage*. This is a deliberate game of strategy in which you and five friends can declare war on each other. *Missile Barrage*, requiring 16K with Extended BASIC, provides a combat arena of 60 assorted mountain ranges with color and sound.

Each soldier's site is embedded in the mountain range. By entering the coordinates for angle and velocity, you guide your missile to wipe out your opponent(s). Sound easy? Well, *Missile Barrage* requires concentration and time for you to acquire a keen sense of strategy. For instance, if you set the coordinates for an opponent and miss, your enemy may figure out your erroneous calculations and return the fire with corrected coordinates . . . right on your head!

You can set the launch angle of your missile anywhere between 5° and 175° and the velocity up to 1500. Velocities above 500 will carry the missile off the top of your screen for a short time, but the missile will return unless its trajectory carries it past the right or left screen border. If you shoot clear off the border, it will be the next combatant's turn. In case of an incorrect entry, simply depress M and reselect.

If your site is on the left side of the screen and you want to destroy your opponent's to your right, set the coordinates between 0° and 90°. However, if you are on the right side of the screen and want to launch your missile to the left side, aim your missiles between 90° and 180°.

Watch out for the blinking Δ (the malfunction alert) on the top left of the screen and listen for its beeping sound. A missile launch malfunction could happen anytime and destroy you. To avoid the malfunction, immediately depress the space bar to stop the launch or you'll lose your turn. If you're too slow, your own missile site will be destroyed.

Destroying an opponent's site is worth 25,000 points. However, for each missile fired, you are fined 5,000 points. The maximum score is 100,000. The site and site player number will disappear as they are destroyed. The object of the game is to be the sole survivor of this missile barrage. Each new run of the game brings a new terrain and new missile sites.

—Susan Remini

```
170.....01A0
460.....049F
670.....06C9
930.....0944
1270...0C78
1470...0F1C
1750...119A
2060...14C2
2360...17E7
2510...1A34
2730...1C86
2870...1EB1
END ...2110
```

The listing:

```
1 GOTO 8000
10 PMODE1,1
20 PCLS
30 DIML$(15)
40 DIMWO$(13)
50 E=0
60 TRN=0:TRT=0:SCR=0:HIT=0:HT=0:
TT=0
70 MM=RND(6)
80 GOSUB1910
90 GOSUB2190
100 CLS
110 IF PLY=1 THEN PLY=0:GOTO 310
120 FORX=1TO6:NAM(X)=0:NEXTX
130 PRINT@138,"COPYRIGHTED"
135 PRINT@206,"BY"
140 PRINT@265,"DAN DROUILLARD"
150 PRINT@333,"1982":FOR X=1TO40
0:NEXTX
```



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```
160 CLS:PRINT@135,"HOW MANY PLAY
ERS ?":PRINT@231,"UP TO SIX CAN
PLAY"
161 NP$=INKEY$
162 IF NP$="" THEN GOTO 161
163 NP=VAL(NP$)
170 IF NP>6 THEN CLS:GOTO160
190 CLS:PRINT@136,"WHATS YOUR NA
ME":GOSUB 2640: FORX=1TO NP:PRIN
T@195+SPC,"PLAYER NO." X;:INPUT
NAM$(X):SPC=SPC+32:NEXTX
200 IF NP=1THEN NS=6:GOTO2400
210 IF NP=0 THEN NP=1:GOTO200
220 IF NP=2THEN NS=6:GOTO2340
230 IF NP=3THEN NS=6:GOTO2300
240 IF NP=4THEN NS=4:GOTO2370
250 IF NP=5 THEN NS=5 :GOTO 2370
260 IF NP=6THEN NS=6:GOTO2370
270 ZP$=INKEY$
280 IF ZP$=CHR$(13)THENGOTO310
290 XM=RND(13)
300 GOTO270
310 GOSUB1280:GOSUB1530
320 DRAW"BM156,192":DRAW"C8R6U5L
6U5R8C5R4C8D10R2C5R6C8U10L4R10C5
R4C8R6L6D5R4L4D5R8C5R8C8U10D2F8D
2U10R2C5R4C8R6D10L6U10R6D10R2C5R
4C8R2"
330 FORX=1TO6:LF(X)=0:WN(X)=0:MZ
(X)=0:NEXTX:ML=0
340 DRAW"BM8,192":GOSUB 1760
345 J=RND(10)
350 D=0:AN=0:AN$(1)="":D$(1)="":
E=0
360 TRN=TRN+1
370 FOR X=1 TO6:MZ(X)=0:NEXTX:ML
=0
380 FORX=1TO5
390 DRAW "C8"
400 DRAWWO$(X)
410 DRAW "C5"
420 DRAW "R4"
430 NEXT X
440 FORX=0TO12:LINE(236,192-X)-(
252,192-X),PRESET:NEXTX
450 IF NP=1THEN GOTO470
460 GOTO490
470 IF MZ(MM)=1THEN GOTO2910
480 IF NP=1 THEN GOTO500
490 MM=MM+1:IF MM>NS THEN MM=1
500 PP=0
510 GOTO2690
520 DRAW"BM240,192":DRAWN$(MM):S
OUND220,1
530 AN$=INKEY$
540 XM=RND(13)
550 IF AN$=""THEN GOTO530
555 SOUND230,1
560 IF AN$="M" THEN DR=0:FORX=0T
012:LINE(68,192-X)-(136,192-X),P
RESET:NEXTX:GOTO530
570 IF AN$=CHR$(13) THEN DR=0:FO
RX=0TO12:LINE(68,192-X)-(136,192
-X),PRESET:NEXTX:GOTO 630
580 IF DR>2 THEN DR=0:FORX=0TO12
:LINE(68,192-X)-(136,192-X),PRES
ET:NEXTX:GOTO530
590 AN(2)=VAL(AN$):GOSUB 2020
600 AN$(1)=AN$(1)+AN$
610 AN=VAL(AN$(1))
620 GOTO530
630 IF AN>180 OR AN<1 THEN AN$="
":AN$(1)="":GOTO 530
640 DRAW "BM8,192":DRAW"C5"
650 FOR X=1 TO 5
660 DRAWWO$(X):DRAW"R4"
670 NEXTX
680 DRAW"BM4,192"
690 DRAW"C8":DRAWWO$(6):DRAW"C5"
:DRAW"R8"
700 FORX=7TO13
710 DRAW"C8"
720 DRAWWO$(X)
730 DRAW"C5"
740 DRAW"R4"
750 NEXTX
760 D$=INKEY$
770 IF D$=""THENGOTO760
772 SOUND250,1
```


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```
775 IF D$="M"THENDR=0:FORX=0TO12
:LINE(92,192-X)-(140,192-X),PRES
ET:NEXTX:GOTO760
780 IF D$=CHR$(13)THEN DR=0:FOR
X=0TO12:LINE(92,192-X)-(140,192-
X),PRESET:NEXT X:GOTO850
790 IF DR>3THEN DR=0:FOR X=0TO12
:LINE(92,192-X)-(140,192-X),PRES
ET:NEXTX:GOTO760
800 AN(2)=VAL(D$):GOSUB2020
810 D$(1)=D$(1)+D$
820 D=VAL(D$(1))/3
830 GOTO760
840 G=1
850 IF D>500 OR D<1 THEN D$="":D
$(1)="":GOTO 760
860 AN=AN/57.29577951
870 H(1)=COS(AN)*D:H(2)=COS(AN)*
3
880 V(1)=SIN(AN)*D:V(2)=SIN(AN)*
3
890 V(1)=192-V(1)
900 V(1)=V(1)-(192-VS(MM))
910 V(2)=V(2)-G
920 H=MS(MM):V=VS(MM)-8
930 R=0
940 IF V<5 THEN GOTO 960
950 LINE(H,V)-(H,V-2),PRESET
960 IF V<V(1) THEN R=1
970 IF R=0 THEN V=V-V(2)
980 IF R=1 THEN V=V+V(2)
990 H=H+H(2)
1010 SE=SE+1
1020 IF H=>250 THEN GOSUB1130:GO
TO1110
1030 IF H<5 THEN GOSUB 1130:GOTO
1110
1040 IF V>156 THEN GOSUB 1130:GO
TO1110
1050 IF V<1 THEN GOTO 940
1060 SCREEN1,1
1080 IF V<5 THEN GOTO 1100
1085 IF J=3THENFORX=1TO4:DRAW"C8
;BM32,44;E16F16L32":SOUND150,5:J
$=INKEY$:IF J$=" " THEN DRAW"C5;
BM32,44;E16F16L32":GOTO 1110ELSE
 ::DRAW"C5;BM32,44;E16F16L32":NE
XTX:V=V+9:FORI=1TO4:H=(MS(MM)-2)
+I:GOSUB1130:NEXTI:GOTO1110
1090 LINE(H,V)-(H,V-2),PSET
1100 IF PPOINT(H,V+2)=6 OR PPOIN
T(H,V+2)=8 OR PPOINT(H,V+1)=8 OR
 PPOINT(H,V)=8 OR PPOINT(H,V-1)=
8  THEN GOSUB 1130 ELSE GOTO 940
1110 DRAW"BM4,192":DRAW"C5":DRAW
 WO$(6):DRAW"R8":FORX=7TO13:DRAW
 WO$(X):DRAW "R4":NEXTX
1120 GOTO340
```


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```
1130 GOTO 1140
1140 IF V<5 THEN GOSUB6000: GOTO
 1270
1150 TA=1
1160 PLAY"T2L7001V30":PLAY"E-"
1170 FORX=1TO2
1180 CIRCLE(H,V),4,8
1190 PLAY"8"
1200 PAINT(H,V+2),8,8
1210 CIRCLE(H,V),4,5
1220 PLAY STR$(X)
1230 CIRCLE(H,V),2,5
1240 PLAY "F-"
1250 NEXTX
1260 PLAY"E-"
1270 RETURN
1280 L$(1)="R6D8L254U8R8"
1290 L$(2)="E20R4E12R8F8R4F24":'
L$=MOUNTAINS
1300 L$(3)="R16E4R12E4R36F8"
1310 L$(4)="E16R20E12R12F8D4F8D4
F4"
1320 L$(5)="E8U12E4R8E4U28R4E4R8
F4D20F4D16R8E8R4F4D4F4D8F4"
1330 L$(6)="E4R16E8U8E4R8F8D4R4F
4R8F4R8F4"
1340 L$(7)="R8E8R12E8R12F12R16F4
"
1350 L$(8)="E8U4E12R44F4D4R4F4D4
F4D4"
1360 L$(9)="R28E4R8E4U8E4R20F4D8
F8"
1370 L$(10)="E16U4E4R4F4D8F8R16E
4R4E4R8D4F8"
1380 L$(11)="U4E8R4E4U8E4U4E4U4E
4U4E4R36F4D20F8D20"
1390 L$(12)="R8U8E12U8R4E4U8R8D2
4R12E4U4R8D20R4E4U4R4F4D4F4"
1400 L$(13)="U4E4U8E4U8E4UE4R4F4
D8F4D8F4R12E4U8E4U4E4R4F4D8F4DF8
D4F4"
1410 PCLS
1420 DRAW"BM248,152"
1430 DRAW"C6"
1440 DRAWL$(1)
1450 MT=0
1460 XM=RND(13):MT=MT+1
1470 IF XM=0 OR XM =1 THEN XM=RN
D(13):GOTO1470
1480 DRAW L$(XM)
1490 IF MT=>3 GOTO 1500 ELSE GOT
O 1460
1500 PAINT(20,154),6,6
1510 SCREEN1,1
1520 RETURN
1530 FORX=1TONS
1540 MS(X)=RND(244)
1550 MS(X)=MS(X)/2
1560 MS(X)=INT(MS(X))
1570 MS(X)=MS(X)*2
1580 MS(X)=MS(X)/2:MS(X)=FIX(MS(
X)):MS(X)=MS(X)*2
1590 IF MS(X)<10 THEN GOTO 1540
1600 FORYY=1TONS
1610 IF YY=X THEN GOTO1650
1620 IF MS(X)=>MS(YY) THEN MX=MS
(X)-MS(YY)
1630 IF MS(X)<MS(YY) THEN MX=MS(
YY)-MS(X)
1640 IF MX<20 THEN GOTO 1540:'SI
TE SPACING
1650 NEXTYY
1660 NEXTX
1670 FORY=1TONS
1680 VS=70
1690 VS=VS+1
1700 IF PPOINT(MS(Y),VS)=6 THEN
VS=VS-2:VS(Y)=VS: GOTO 1710 ELSE
 GOTO 1690
1710 FOR X=1 TO 8 :PSET(MS(Y)-4+
X,VS,8):NEXTX
1720 FOR X=1 TO 4:PSET(MS(Y),VS-
4+X,8):NEXTX
1730 LINE(0,176)-(MS(Y),176),PRE
SET:DRAW"C5":DRAW"U2":DRAW"C8":D
RAW N$(Y)
1735 SOUND245,1
1740 NEXTY
1750 RETURN
```


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```
1760 WO$(1)="U10R6D5L6R6D5R2"
1770 WO$(2)="U10D2F6D2U10D10R2"
1780 WO$(3)="U10R6L6D10R6U5L2R2D
5R2"
1790 WO$(4)="U10D10R6R2"
1800 WO$(5)="U10R6L6D5R4L4D5R8"
1810 WO$(6)="H4U6D6F4R2E4U6D6G4"
1820 WO$(7)="U10R6L6D5R4L4D5R8"
1830 WO$(8)="U10D10R8"
1840 WO$(9)="U10R6D10L6R8"
1850 WO$(10)="U10R6L6D10R8"
1860 WO$(11)="U10D10R2C5R4"
1870 WO$(12)="U10L4R8L4D10R2C5R8
"
1880 WO$(13)="U5L4U5D5R8U5R2"
1890 RETURN
1900 GOSUB1910
1910 N$(1)="C5R6C7U10D10"
1920 N$(2)="C5C7U2E6U2L6R6D2G6D2
R6"
1930 N$(3)="C5C7R6U5L2R2U5L6R6D1
0"
1940 N$(4)="C5R6C7U10D5L6U5"
1950 N$(5)="C5C7R6U5L6U5R6"
1960 N$(6)="C5C7U10D10R6U5L6"
1970 N$(7)="C5R6C7U10L6"
1980 N$(8)="C5C7R6U5L6R6U5L6D10"
1990 N$(9)="C5R6C7U10L6D5R6"
2000 N$(10)="C5C7U10R6D10L6"
2010 RETURN
2020 DR=DR+1
2030 IF DR=1 THEN DRAW"BM100,192
"
2040 IF DR=2 THEN DRAW"BM110,192
"
2050 IF DR=3 THEN DRAW "BM120,19
2"
2060 IF DR=4 THEN DRAW"BM130,192
"
2070 IF AN(2)=0 THEN DRAWN$(10)
2080 IF AN(2)=1 THEN DRAWN$(1)
2090 IF AN(2)=2 THEN DRAWN$(2)
2100 IF AN(2)=3 THEN DRAWN$(3)
2110 IF AN(2)=4 THEN DRAWN$(4)
2120 IF AN(2)=6 THEN DRAWN$(6)
2130 IF AN(2)=5 THEN DRAWN$(5)
2140 IF AN(2)=7 THEN DRAWN$(7)
2150 IF AN(2)=8 THEN DRAWN$(8)
2160 IF AN(2)=9 THEN DRAWN$(9)
2170 IF DR=5 THEN DR=0
2180 RETURN
2190 NE$(1)="R6U10D10"
2200 NE$(2)="U2E6U2L6R6D2G6D2R6"
2210 NE$(3)="R6U5L2R2U5L6R6D10"
2220 NE$(4)="R6U10D5L6U5"
2230 NE$(5)="R6U5L6U5R6"
2240 NE$(6)="U10D10R6U5L6"
2250 NE$(7)="R6U10L6"
2260 NE$(8)="R6U5L6R6U5L6D10"
2270 NE$(9)="R6U106D5R6"
```


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```
2280 NE$(10)="U10R6D10L6"
2290 RETURN
2300 CLS:PRINT@131,NAM$(1);:PRIN
T@136,"-YOU HAVE SITES# 1,4"
2310 PRINT@195,NAM$(2);:PRINT@20
0,"-YOU HAVE SITES# 2,5"
2320 PRINT@259,NAM$(3);:PRINT@26
4,"-YOU HAVE SITES# 3,6
2330 GOSUB 2640:GOTO 270
2340 CLS:PRINT@163,NAM$(1);:PRIN
T@168,"-YOU HAVE SITES# 1,3,5"
2350 PRINT@259,NAM$(2);:PRINT@26
4,"-YOU HAVE SITES# 2,4,6"
2360 GOSUB 2640:GOTO 270
2370 SPC=0
2380 CLS:FOR X=1 TO NP
2390 PRINT@131+SPC,NAM$(X):PRINT
@131+SPC+5,"-YOU HAVE SITE NO.-"
X:SPC=SPC+32:NEXTX:GOSUB2640:LIN
E INPUT CON$:GOTO 310
2400 CLS:PRINT@103,"THE COMPUTER
 WILL":PRINT@167,"SELECT A SITE
FOR":PRINT@231,"YOU TO FIRE FROM
":PRINT@295,"GO FOR HIGH SCORE!!
":GOSUB2640:INPUTCON
2410 CLS:PRINT@37,"EACH MISSLE L
AUNCHED":PRINT@101,"COST YOU 500
0 POINTS":PRINT@166,"EACH SITE D
ESTROYED":PRINT@228,"GIVES YOU 2
5,000 POINTS":PRINT@292,"PERFECT
 SCORE IS 100,000 ":PRINT@361,"G
OOD LUCK!!":GOSUB2640:INPUTX:GOT
O310
2420 IF NP=3THENGOTO2520
2430 IF NP=2THENGOTO2610
2440 FORTX=1TONS
2450 ML=ML+MZ(TX)
2460 IF NP=1 THENGOTO2480
2470 IF ML=NS-1THEN GOTO2650
2480 IF ML=NS-1THEN GOTO2920
2490 NEXTTX
2500 ML=0
2510 RETURN
2520 IF MZ(1)+MZ(4)=2 THEN LF(1)
=1
2530 IF MZ(2)+MZ(5)=2 THEN LF(2)
=1
2540 IF MZ(3)+MZ(6)=2 THEN LF(3)
=1
2550 FORX=1TO3
2560 IF LF(1)+LF(2)=2THEN WN=3:G
OTO2770
2570 IF LF(1)+LF(3)=2THEN WN=2:G
OTO2770
2580 IF LF(2)+LF(3)=2THEN WN=1:G
OTO2770
2590 NEXTX
2600 GOTO 2510
2610 IF MZ(1)+MZ(3)+MZ(5)=3THEN
WN=2:GOTO2770
2620 IF MZ(2)+MZ(4)+MZ(6)=3THEN
WN=1:GOTO2770
2630 GOTO2510
2640 PRINT@452,"PRESS ENTER TO C
ONTINUE":RETURN
2650 FORX=1TONS
2660 IF MZ(X)=0THEN WN=X
2670 NEXTX
2680 GOTO 2770
2690 FORY=1TONS
2700 PP=0
2710 FORX=1TO8:IF PPOINT(MS(Y)-4
+X,VS(Y))=8 THEN PP=PP+1:NEXTX
2720 FORX=1TO8:IF PPOINT(MS(Y),V
S(Y)-4+X)=8 THEN PP=PP+1:NEXTX
2730 IF PP<2 THEN MZ(Y)=1:GOSUB2
420:LINE(0,176)-(MS(Y),176),PRES
ET:DRAW"C5":DRAW"U2":DRAW NE$(Y)
:GOSUB 3030
2740 NEXTY
2750 GOSUB2420
2760 IF MZ(MM)=1 THEN GOTO 450 E
LSE GOTO 520
2770 CLS:PRINT@195,NAM$(WN);:PRI
NT@200,"-YOU WON!!":NAM(WN)=NAM(
WN)+1:GOSUB2640:INPUTX
2780 WN=0
2790 CLS:PRINT@256,"DO YOU WANT
TO SEE TOTAL SCORE
```


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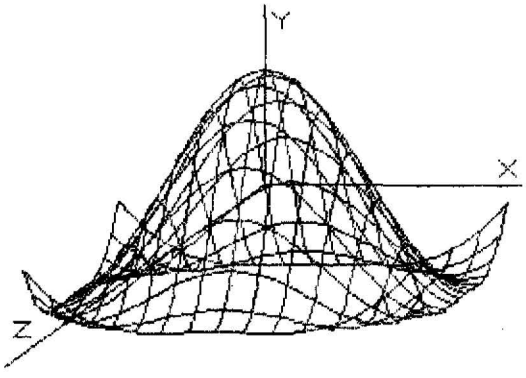
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```
Y/N"
2791 X$=INKEY$
2792 IF X$="" THEN GOTO 2791
2793 IF X$="Y"THEN  GOTO2800 ELS
E GOTO 2830
2800 SPX=0:CLS
2810 FORX=1TONP:PRINT@131+SPX,NA
M$(X);:PRINT@130+SPX+6,"-YOU WON
 "NAM(X)" GAMES":SPX=SPX+32
2820 NEXTX:GOSUB2640:INPUTX
2830 CLS:PRINT@353,"DO YOU WISH
TO PLAY AGAIN Y/N"
2840 ED$=INKEY$
2841 IF ED$="" THEN GOTO 2840
2850 IF ED$="N" THEN GOTO 2900
2860 CLS:PRINT@192,"DO YOU WANT
TO CHANGE THE NAMES     OR NUMBER
 OF PLAYERS  Y/N"
2870 ED$=INKEY$
2871 IF ED$="" THEN GOTO 2870
2880 IF ED$="N" THEN PLY=1:GOTO
50
2890 GOTO50
2900 CLS:PRINT "BYE":END
2910 PRINT" ":FORX=1TO8:SOUND100
,2:CLSX:PRINT@195,"YOU JUST DEST
ROYED YOURSELF";:NEXTX:FORX=1TO5
00:NEXTX:GOTO2920
2920 TRN=TRN-1:IF TRN=<0THEN TRN
=0
2930 TT=TRN*5000
2940 IFMZ(MM)=1THEN MZ(MM)=0
2950 FORX=1TO6
2960 IF MZ(X)=1 THEN HIT=HIT+1
2970 NEXTX
2980 IF HIT<0THENHIT=0
2990 HT=HIT*25000
3000 SCR=HT-TT
3010 CLS:PRINT@163,NAM$(1);:PRIN
T@168,"-YOUR SCORE IS ";:PRINTSC
R
3020 GOSUB2640:INPUTX:GOTO2830
3030 FORX=1TO8:PSET(MS(Y)-4+X,VS
(Y),5):NEXTX
3040 FORX=1TO4:PSET(MS(Y),VS(Y)-
4+X,5):NEXTX
3050 RETURN
6000 PLAY"T2L17001V30":PLAY"E-"
6010 FOR X=1 TO 3
6015 FORV=1TO30:NEXTV
6020 PLAY"G"
6030 PLAY STR$(X)
6035 FORV=1TO30:NEXTV
6040 PLAY"F-"
6050 NEXTX
6060 PLAY"E-"
6070 RETURN
8000 PCLEAR2:GOTO10
```


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CONTRACT BASICS FOR THE COMPUTER USER

BY TOM NELSON
RAINBOW CONTRIBUTING EDITOR

How many things can you think of to argue about with a friend on the qualities of various computers or programs? Come on now, be honest. Hundreds, right? Sometimes it is a wonder that you can even agree that the computer has the name on its cover.

Well, that's just arguing mostly for fun. It can get heated, but it doesn't really mean much in the end. Anyway, you can't control the inards of the computer, so what the heck?

Contracts, like programs, are something we can create and control. As with programs, the better we control the contract, the less possibility there is that the contract will "bomb." The more that is at stake, the more the chance that failure to control the contract can lead to personal business failure.

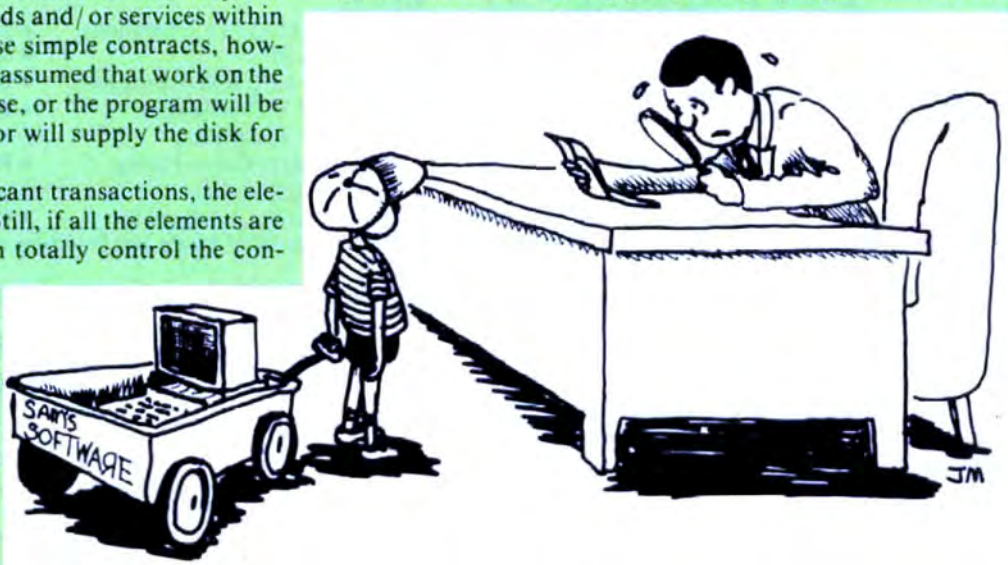
Contracts are everyday parts of life. In fact, we each make one or more oral contracts every day. "I'll wash that car if you dig the garden;" "if you give me a copy of your finished program, I'll help you with your bug," and so on. These are just simple contracts; oral contracts at that (yes, ma, oral contracts are perfectly legal, with certain exceptions).

Of course, there are just simple contracts with very few terms. There's an exchange of goods and/or services within a certain time frame. Even in these simple contracts, however, much is left unsaid. It may be assumed that work on the program will be done at your house, or the program will be given on disk, or maybe the author will supply the disk for the program.

As contracts cover more significant transactions, the elements to be considered increase. Still, if all the elements are carefully considered, you still can totally control the contract. Yet, much like a complicated program, not all contingencies can always be successfully covered in a contract. There may be some element that was totally neglected, or left to the business "operating system."

Contract law is made of rules to interpret contracts. The rules have two functions. First, trained persons can build contracts around known rules which will control significant parts of the contract without the need to write long contracts covering every possible situation. The Uniform Commercial Code, a voluminous law covering merchants adopted by most states, was designed specifically for this purpose. The second function of contract rules is to interpret contracts which have gone awry, or were poorly drafted. Courts will look at the contract and apply uniform principles to attempt to salvage the contract or to help an injured party. The most important thing to remember about all this is that if you don't cover a term in your agreement and that term becomes the center of controversy, general contract rules will define the term for you, whether or not you approve.

These rules are not written in stone. If you wish, you may contract these rules away, provided the purpose is not crim-



(Tom Nelson is a Special Assistant Attorney General for the State of Minnesota representing various state agencies, and a consultant to Nelson Software Systems. He has written almost all the manuals for the programs in the Super "Color" Library.)

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inally illegal or otherwise improper. You are the master of your contract. The more you understand it, the more you are in control. What you want to do is cover every essential term, make a total agreement between the parties spelling out how you want things done so that you can avoid later misunderstandings and avoid surprises should the contract rules be applied.

This brings me to a little anecdote. People say that lawyers and long contracts "queer" deals. Lawyers come in and write up long contracts covering everything down to the size of the pencil eraser to be used for cleaning disk pack plugs. It's actually true that legal gobbledygook can be pretty intimidating. Of course, those with power are aware of this, so they make sure all contracts, no matter the size, are fashioned to fit on one page. Thus what could take 10 or so pages in normal type sizes is squished and crammed into one page, the "fine print" of which we are all so fond. The consumer feels that whatever is on that one page cannot be so bad or harmful since it is only one page. But let the contract flow onto two pages and people balk at signing it. Suddenly it becomes a looming legal document, with overtones of attorneys, etc.

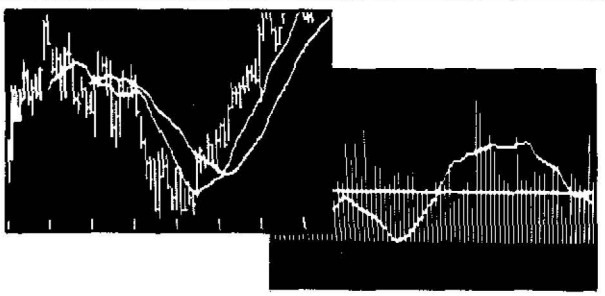
When I was buying a house, I naively wrote up a purchase agreement of six or so pages in the normal print size. It amounted to no more text than the standard, single-sheet, fine-print, realtor-supplied purchase agreement. Yet, when I presented it to several home sellers, I and it were rejected as being suspicious. Why couldn't I use those nice single-sheet forms? After several such experiences, and several houses later, I finally did just that, changing the terms on the single sheet that I couldn't stomach, and the deal was closed.

This "single-sheet" mentality is not limited to home or car purchases. The same psychology applies to any industry. I have seen several computer software license agreements which fit nicely onto one page, but they sure can say a lot—or leave a lot unsaid. And lo and behold, that one page becomes four to five pages if printed in a normal print font. Since you want to control your contract, you have to avoid the temptation to rely on the "single-sheet" mentality. Sure, if the terms seem fair or adequate, you should consider signing the single-sheet contract; but if its terms seem lopsided or it doesn't contain the terms you want, that one page has got to become more. Don't let that pretty form turn your head.

Now that you are past the fear of putting your head to work to control your contract, let's get to know some more about contracts. First, a little more on the "whats" of a contract. A contract is an agreement between two or more persons to exchange something of value. A contract can be oral or in writing, with some exceptions. For example, no agreement with a merchant to purchase something worth over $500 is valid unless in writing, and no contract for the performance of services which cannot be performed within one year is valid unless in writing.

As you can see, many things can be covered by an oral contract. And oral contracts are fully binding and enforceable. Still, oral contracts have problems which make them unattractive. One problem is that of proof. Problems of proof arise not only from "little white lies," but also from ambiguity of terms, and actual misunderstandings. Another

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equally important problem is that oral agreements generally cannot be of any great complexity. It's hard to successfully specify limitations to a worldwide license over the phone and have both parties remember whether or not Outer Slabovia was included.

It is obviously wise to put all significant agreements into writing. Thus, I want to devote the remainder of this column to introducing you to the formal characteristics of contracts so that you can more easily find your way through them.

All contracts have several sections in one shape or another. Contracts covering the same general subject matter also tend to look very similar. The first section of the contract sets out the parties to the agreement. The second part sets out the purposes of the contract. In old fashioned contracts these were the "Whereas" clauses. A third section usually is devoted to definitions of important terms. Next comes the body of the contract containing the essential terms. The body of the contract can contain many sections, each devoted to a particular significant area of concern. After the body comes what I call the boiler plate. The boiler plate clauses cover many important standard elements of contract law. Finally comes the signature block. Many agreements also have attachments of one sort or another, often called exhibits. Very simple contracts lack almost all of these items. All that is needed is a general statement of the nature of the agreement and the signatures of the parties. The rest of the parts are added as the agreement becomes more important.

"You are the master of your contract . . . (so) you want to . . . cover every essential term, make a total agreement between the parties spelling out how you want things done so that you can avoid later misunderstandings and avoid surprises should the contract rules be applied."

Of course, the names and addresses of the parties should be clearly stated at the beginning of the agreement. Next, the purposes of the agreement. It is always helpful to state the purposes of the agreement. This section is often used to set the tone for the rest of the agreement, and to show the intent of the parties. This latter use is often helpful when structuring the agreement to make it fit within some particular legal niche. For example, to create a valid work-for-hire agreement, the contract should recite certain basic elements. Similarly, to create an independent contractor relationship, as opposed to an employment relationship, thereby avoiding certain tax and insurance liabilities, the agreement should recite the requisite independent contractor elements.

The definition section gives a convenient place to make sure that any important terms be clearly understood by the parties. Definitions perform two functions. First, definitions are used to allow one term, such as "Program," to be used throughout the agreement to include the source and object code for a program with a specific title. Definitions are also important to establish the meanings of key terms



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and concepts such as "Improvements" or "Royalties." Often, poor definitions cause great trouble in agreements. Care in thinking out the ramifications of the agreement will lead to comprehensive definitions to clearly guide the parties. What needs defining will differ with every contract, so you will have to be in good control of your agreement.

The body of the contract contains the significant terms, such as who gives what to whom at what time and under what conditions. These clauses cover the price and quantity terms specific to this particular agreement, and is generally the section most subject to negotiations. Many contracts contain standard definition and boiler plate sections, and leave the middle open for inclusion of the vital terms.

The boiler plate contains several items, all of which are important. These items are often non-negotiable. One party will set out the basic boiler plate under which it will proceed, and since this party usually has the better bargaining position, the terms will be accepted. The boiler plate includes

"Definitions are . . . important to establish the meanings of key terms and concepts such as "Improvements" or "Royalties." Often, poor definitions cause great trouble in agreements."

such things as which state's laws will be applied to the agreement, what assignment rights exist, and other clauses to avoid waiver of rights and voiding of the whole contract by a court if just one part is bad.

As for signatures, each party must sign the agreement, but witnesses are not required, nor need the document be notarized. One interesting note is that anything intended by a party as a signature works as a signature, including an "X," a thumbprint or initials.

To the agreement may also be added some exhibits or schedules. These can have many purposes. Some attorneys write skeleton agreements, referring always to this or that exhibit for the specific details. Other attorneys like to write a totally integrated agreement with no exhibits. Some write a totally integrated form contract and use a "schedule" to customize the standard agreement to the particular party and product covered by the specific agreement.

It should have become clear by now that contracts can be different and complex. You should, however, be able to find your way through most contracts and understand the reasons for the various parts. If you locate some contracts of the type you wish to create, you will soon learn of the concerns common to the particular industry involved. With some reflection and knowledge you should be able to spot what is not being said as well as what is. With that you can begin to think of alterations and additions to give you full control of your agreement.

With this background we are ready next time to look at the concerns common to the software industry in the acquisition and marketing of software. Until then, get the oral out of your contracts.

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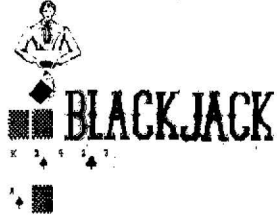
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Two 'Bumbles' Make Learning Enjoyable

The Follett Library Book Company has developed, through The Learning Company, two programs for teaching children how to locate positions on arrays and grids. According to the introduction, students ". . . will need this skill to find streets on maps, to build charts and graphs and to design computer graphics." This reviewer would add latitude and longitude.

I was immediately impressed with the packaging of the programs. One of the problems with educational materials is durability. The Follett Company has each diskette enclosed in a self-sealing vinyl case and the multi-colored instruction booklet in a transparent sleeve on the cover.

The two programs, *Bumble Games* (for ages four to 10) and *Bumble Plot* (for ages eight to 13), come on either cassette or disk. Both programs are designed to teach X,Y coordinates beginning with horizontal lines and then vertical lines, increasing with difficulty according to mastery levels.

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Bumble Games has six programs, including Find Your Number, Find The Bumble, Butterfly Hunt, Visit From Space, Tic Tac Toc and Bumble Dots. *Bumble Plot* has five games: Trap And Guess, Bumblebug, Hidden Treasure, Bumble Art and Roadblock.

The "Bumble" is a colorful cartoon bug that leads you through the precise instruction booklet that not only explains how to use a cassette or disk but includes photographs of the Color Computer keyboard with necessary program keys highlighted, plus actual color photographs of each program screen. The directions actually give hints on how to win the games.

Teachers and students will enjoy the author's ability to make learning enjoyable through excellent program designs, graphic numbers and letters, sounds and music (I enjoyed the Westminster Chimes and "bell" to count the proper number guess in one program).

Each series is set up to first teach horizontal coordinates. *Bumble Games* starts with "Find Your Number" from zero to five, while *Bumble Plot* begins with "Trap And Guess" that goes from negative three to positive three. The second phase, when the child comprehends horizontal coordinates, is both horizontal and vertical (X,Y) locations. The younger children's version uses graphic letters for the horizontal line and graphic numbers for the vertical. The older student's version uses numbers from negative two to positive two for both axes. The games require the students to find, hunt, outwit, play against another student, and generally have fun, but always developing and using the horizontal and vertical locations on the grids. As the student advances, the grids and arrays become more complex, but each program continues giving sentence clues (in graphic letters) or arrows for proper direction on the grid.

Almost as a bonus, each series includes an art program that allows the student to either plot his own drawing or have the program, using a cursor, tell him where to list the X,Y coordinates. In either case, when the picture is completed, the grid is automatically erased and painted by the computer.

My children Jennifer (first grade), David (fourth grade) and Michael (sixth grade) thoroughly enjoyed the programs.

While my children were able to do the programs and figure out the X,Y coordinates, it should be noted that the purpose of *Bumble Games* and *Bumble Plot* is to aid the teacher in teaching place location on maps, grids and arrays. The programs, while they can stand alone, are the first programs being marketed by the Follett Company with the idea of computer aided instruction (C.A.I.). The teacher is still required to teach the basics and then use the computer to back up and expand upon the classroom instruction. The Follett Library Book Company is to be commended for developing programs for the TRS-80 Color Computer and showing how students and educators can benefit from classroom computers.

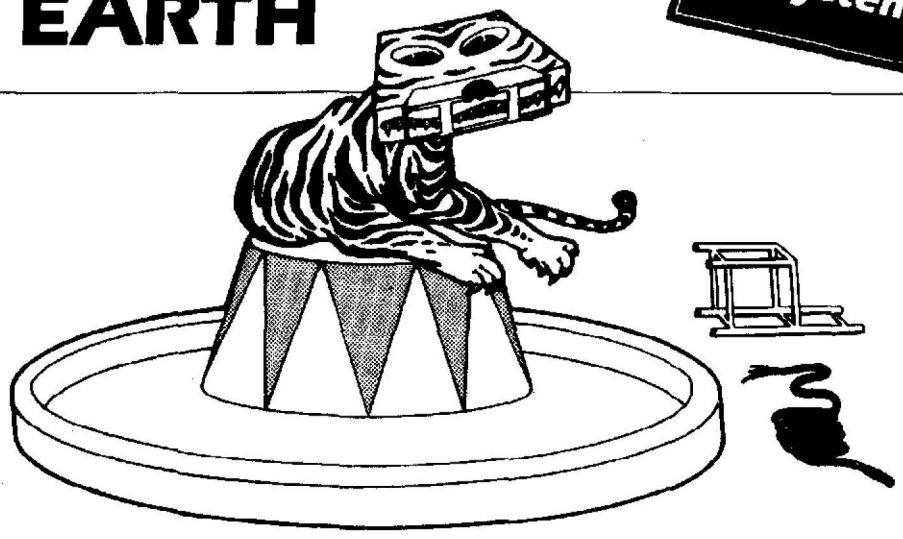
Each program has a 90-day warranty from defects, and back-up copies can be obtained from the company with a "certificate" and proper payment for the disk.

(Follett Library Book Company, 4506 Northwest Highway, Crystal Lake, IL 60014, 16K ECB, cassettes $45 for either program, diskettes $65)

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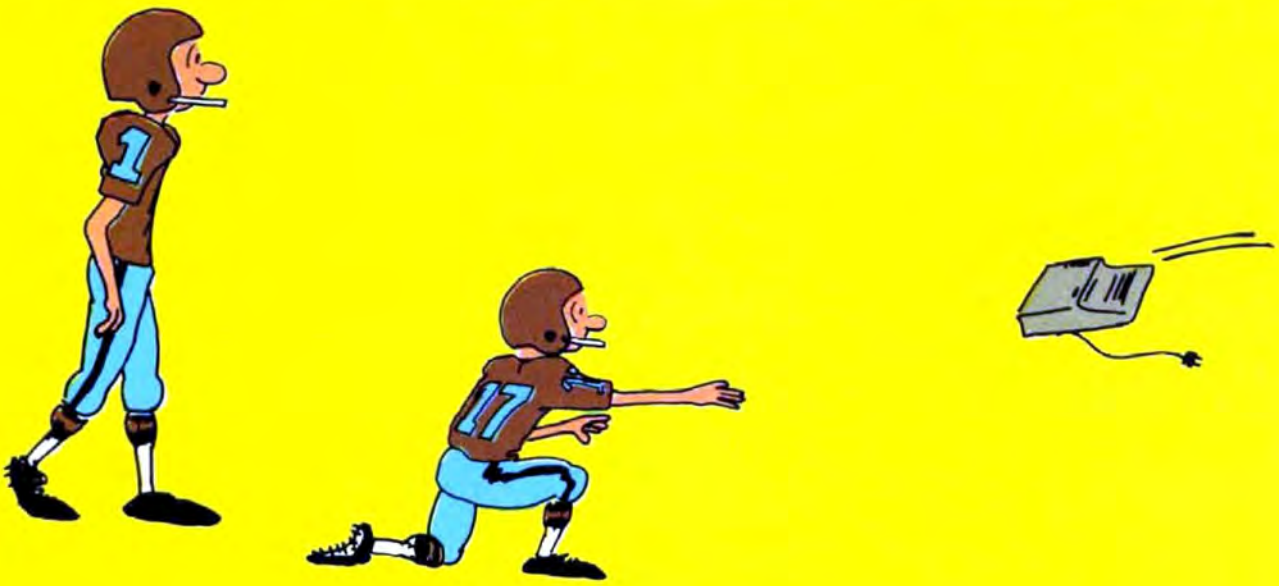
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The Fine Print: All issues from July 1981 available — ask for list. Programs are for the Extended BASIC model and occasionally for disks.

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Ever since my first football simulation game on an IBM 360/35 way back in 1967, I have been fascinated with a computer's ability to simulate real events and make realistic playing field decisions. I produced versions of this game on a Tektronix 4051 microcomputer and a PDP-11 mini in the last 10 years. With the purchase of my Color Computer I had a new challenge: make it easy enough for anyone to play *and* make it challenging enough for a real football buff. I think I've succeeded.

This is a game that makes you the coach; or, if you're the athletic type, the quarterback and the defensive signal caller. *Strategy Football* is not a graphics game, so it doesn't matter if you have joysticks or good hand-eye coordination. *Strategy Football* is a "thinking person's" football. You are guided through the game with a display of the scoreboard (including the time remaining), and the play situation. You'll see the outcome of each play just as Howard Cosell or Keith Jackson might tell you.

You have the choice of team names. You can tailor the team rushing, passing, defense, and kicking games to your favorite teams (or rivals). As a play caller you have nine offensive plays to choose from and five defenses. You can onside kick when necessary or call a timeout to stop the clock. The play outcomes are dependent upon your play selection, the opponent's play selection, a history of play outcomes from actual NFL records, and, of course, some random occurrences. Big breaks happen now and then. The game clock tells you how much time you have left but each team can call three timeouts per half. When a team scores, the band plays and the crowd cheers. The referee's whistle blows every play dead. But watch out for the penalties that the referees call; they can stop a drive just when you need it.

There's a halftime show to keep you entertained. Sorry, no Dallas Cowboy cheerleaders. The game takes over 30 minutes to play even if you call the quick plays and don't stop the clock with sideline passes. There is a provision to save your game onto tape or disk and come back to it later. You can play NFL or NCAA rules; your Color Computer read the rulebook and knows the differences. You can have a one player game and play against the computer (it wins now and then) or you can have a two player game and turn your friends into nervous wrecks. Or, if you're a football fan who prefers to just watch the game, you can play the zero player game with the computer playing its alter ego (Sam?). Be ready for the next football strike.

Load the tape or disk version. Type *RUN*. The *Strategy Football* logo will appear and ask if you want to play a saved game. If you have one saved, simply type Y and the game will start where you left off. If you type N the game will begin with prompts for information.

First type the two team names (no more than twelve characters). Type the city or school rather than the nickname. This helps the grammar sound correct when you get the play situation. For instance, type "Dallas" rather than "Cowboys," or "Penn State" rather than "Lions." Next, choose NFL (pro) rules or NCAA (college) rules. If you want to play high school rules, choose NCAA. Next, choose the mode. Zero is the computer versus itself. Fun to watch, but not much of a challenge. The others are self-explanatory.

Next, choose the team strengths. You have five categories for each team. Strength can range from 0 to 10 on each category. The limit is that the total must equal 10. Therefore, for a perfectly balanced team, type 2 for all

---

(Dr. Tyson holds a Ph.D. in physics. He is a Senior Systems Engineer working on high energy laser beam control system development and computer simulation. He and his family live in Jupiter, Florida.)

STRATEGY FOOTBALL



By Dr. Bob Tyson

categories. For a team with a good running game but no passing game, type 4:0:2:2:2. These can have a great effect on play outcomes; be realistic—Earl Campbell, Dan Fouts, and Jack Ham don't play on the same team!

The game will begin with the coin toss. From this point on the computer will prompt either team for a response. If the response would come from the computer playing, then it'll happen before you know it.

When you get to a scrimmage play choice (that is, choosing an offensive or defensive play), you can continue with the game, call a timeout for this play, or save the game at this point. If you call a timeout, you will be told how many you have left, if any, and the time for the next play will be very short. If you want to save the game type a lower case (s). Do this by typing (shift) 0, and then "S," (shift) 0 to exit the mode. The computer will prompt you for a save to tape or disk. CAUTION: If you do not have disk BASIC, do not choose the disk *SAVE* mode. The computer will give you a ?SN ERROR and execution will stop.

For those interested in tailoring the game to their specific interests, a few notes are in order. If the words whiz by too fast, just change the delay in lines 126, 127, and 128. Double the limit in the *FOR:NEXT* loop. Lines 1-83 are the initialization lines. A master loop begins at line 87 where all things are decided, like the play situation (is it a scrimmage play, a kickoff, or an extra point try?). This is reminiscent of my FORTRAN Namelist upbringing. The variable "L" is the mode. From line 106 the branch is to 134 for a kickoff, line 213 for a scrimmage play, and line 357 for an extra point try. Other major variables are MD (0, 1, or 2 players); YL (yardline -70 to +70); PO (the offensive play); PD (the defensive play); and BT (the team with the ball). Line 178 is an example of the ball changing hands. DATA lines 545-549 contain the basic results without team strengths factored in or randomness. If the game of football does not interest you, but you've read this far, consider the challenge of finding just how the play outcomes are really determined. It *is not* straightforward. For the music buffs, identify the pep songs played throughout the game and you deserve to be spotted seven points in your next game.

When you play *Strategy Football,* don't try to "outthink" the game or "beat" the game by looking at the *DATA* statements and trying to figure out what to choose. Just play the game like football. Think football. When it's necessary to onside kick, do it. Remember, the ball won't travel very far . . . but there is a good chance of a fumble. Also, when going for a field goal, realize that a kick inside the 20 yard line is almost a sure thing. Almost! A kick from outside the 40 yard line is tough, but possible.

Your offensive plays all have things going for them:

1) The dive play is good for short yardage situations. It's good for 1 or 2 yards almost always.
2) The trap play is the basic running play to the inside. It's hard to stop for a few yards unless the defense is keyed on the runner.



3) The sweep is the basic outside running play. It can be stopped with a keying defense or the blitz. It can also break it big!
4) The reverse is a "gadget" play. This will either go long or lose yardage.
5) The slant pass is a pass play to the tight end over the middle. A zone defense can beat it, but it can go for big yardage.
6) The sideline curl pass is a good medium yardage pass. It's good to stop the clock and hard to intercept. But when it is intercepted, watch out! The defense has nothing but daylight to score.
7) The fly pass is "the bomb." The split end streaks down the sideline and catches it for a big gainer. Beware of a blitz. This pass takes a long time to throw and a blitzing defense can sack the quarterback.

The defensive plays also have special uses:

1) A 5-3 man-to-man is the basic defense. You key on the runner and guard the receivers man-to-man. This is better against the run.
2) A 4-4 zone is the basic anti-pass defense. The backs cover a zone rather than a man. A sweep can beat this defense.
3) A 5-3 zone strong side is good at rushing the passer (five man) and it can usually stop the most common strong side passes. Watch out. The weak side is vulnerable and you might get burned.
4) A 4-4 blitz looks like the 4-4 zone except the safety and one linebacker rush the passer. This defense can be devastating to a pass play and can usually stop a short yardage running play. Be careful here. The blitz leaves the receivers open usually just enough.
5) The prevent defense (pronounced PRE-vent) will stop virtually all long gainers when the offense has "pulled out all the stops." A few long gainers can happen; that's the game of football. Oh yes, the prevent practically gives away the 10 to 20 yard play, so use it sparingly.

Well, that's *Football Strategy*. Put on your helmet and go to it. A few bumps and bruises and you'll be an expert.

The listing:

```
27..... 02E3   296.....2355
50..... 058C   325.... 26D5
76..... 07FA   344.... 291D
87..... 0A16   371.... 2C43
106.... 0C2A   388.... 2E5F
136.... 0FBD   419.....3213
162.... 11FA   440.....3498
186.... 145C   469.....3779
219.... 17EF   488.... 3A5B
236.... 1A90   510....3CD0
256....1DBE    534.... 3F3A
280.....2107   END....4281
```

```
5 CLEAR500:GOTO550
6 PRINT@449,"":G$=INKEY$
7 DIMS(2),SR(2,5),N$(2),L$(12),Q
(2)
8 I=RND(TIMER)
9 GOTO489
10 CLS:PRINT@70,"CHOOSE TEAM NAM
ES"
11 PRINT:PRINT:PRINT
12 FORI=1TO2
13 PRINT"TEAM #";I:INPUTN$(I)
14 IFLEN(N$(I))>12THEN15ELSE16
15 PRINT"ONLY 12 CHARACTERS...TR
Y AGAIN":GOTO13
16 NEXTI
17 FORI=1TO2:L$(1)="
"
18 IFLEN(N$(I))=12THEN20
19 N$(I)=N$(I)+RIGHT$(L$(1),12-L
EN(N$(I)))
20 NEXTI
21 CLS
22 CLS:PRINT@70,"CHOOSE LEAGUE R
ULES":PRINT@160,"1=NFL OR 2=NCAA
"
23 INPUTRU:IFRU=1ORRU=2THEN24ELS
E21
24 IFRU=2THENPLAY"T403L3C02L8B03
L4DCP8L3FL8EL4GFP8AP16AP16AP16AP
16L2AP2L4GFGA-AL3B-L4FBAB-04CD03
L3AL8GL2F"
25 CLS:PRINT@70,"CHOOSE NUMBER O
F PLAYERS":PRINT:PRINT"0=COMPUTE
R VS. COMPUTER":PRINT"1=YOU VS.
COMPUTER":PRINT"2=TWO PLAYERS"
```


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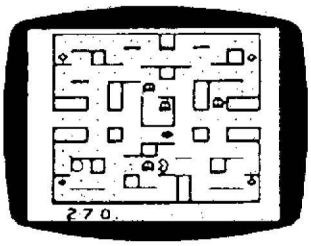
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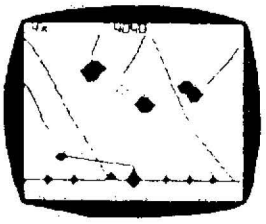
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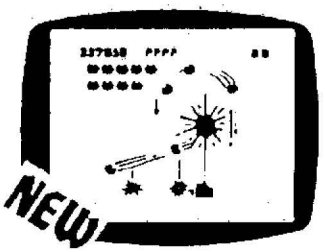
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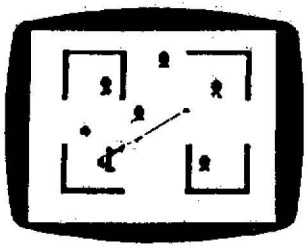
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```
26 INPUTMD:MD=INT(MD):IFMD<ØORMD
>2THEN25
27 CLS:PRINT@7Ø,"CHOOSE TEAM STR
ENGTHS":PRINT:PRINT"TOTAL MUST A
DD TO 1Ø":GOSUB126
28 L$(1)="RUSHING OFFENSE":L$(2)
="PASSING OFFENSE":L$(3)="RUSHIN
G DEFENSE":L$(4)="PASSING DEFENS
E":L$(5)="KICKING GAME    "
29 FORI=1TO2
3Ø FORK=1TO5:SR(I,K)=Ø:NEXTK
31 FORK=1TO5
32 CLS:FORJ=1TO5:PRINT@14+(J+1)*
32,L$(J);SR(I,J):NEXTJ
33 PRINT@224,N$(I):GOSUB35:PRINT
@258,L$(K):INPUTSR(I,K):GOSUB35:
IFSR(I,K)<ØORSR(I,K)>1ØTHEN48
34 GOTO37
35 T=Ø:FORJ=1TO5:T=T+SR(I,J):NEX
TJ
36 PRINT@5ØØ,"TOTAL ";T:RETURN
37 IFT=1ØTHEN4Ø
38 IFT>1ØTHEN49
39 NEXTK
4Ø IFT<>1ØTHEN49ELSECLS:PRINT"VE
RIFY SELECTIONS":PRINT:PRINTN$(I
):PRINT:FORK=1TO5:PRINTL$(K);SR(
I,K)
41 NEXTK
42 PRINT"PRESS <ENTER> TO CONTIN
UE,              <N> TO REDO"
43 G$=INKEY$:IFG$=""THEN43
44 IFG$="N"THEN31
45 IFG$="Y"THEN46
46 NEXTI
47 GOTO5Ø
48 PRINT"VALUE TOO HIGH":GOSUB12
7:GOTO32
49 PRINT"TOTAL MUST EQUAL TEN":G
OSUB127:GOTO3Ø
5Ø CLS:PRINT"        COIN TOSS"
51 ONMD+1GOTO69,52,72
52 GOSUB54
53 GOTO58
54 PRINTN$(1)
55 PRINT"CHOOSE <H>EADS OR <T>AI
LS"
56 G$=INKEY$:IFG$=""THEN56
57 IFG$="H"ORG$="T"THENRETURNELS
E56
58 IFRND(2)=1THEN59ELSE61
59 PRINT" HEADS IT IS !!":GOSUB1
26
6Ø IFG$="H"THEN65ELSE63
61 PRINT" TAILS IT IS !!":GOSUB1
26
62 IFG$="T"THEN65ELSE63
63 PRINT" YOU LOSE,  ":PRINTN$(2
```


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```
);" WILL RECEIVE":GOSUB127
64 BL=1:GOTO84
65 PRINT" YOU WIN THE TOSS...WIL
L YOU      <K>ICK OR <R>ECEIVE?"
66 G$=INKEY$:IFG$=""THEN66
67 IFG$="K"THENBL=1ELSEIFG$="R"T
HENBL=2
68 GOTO84
69 IFRND(2)=1THENBL=1ELSEBL=2
70 PRINTN$(BL);" WINS THE TOSS":
PRINT"AND WILL RECEIVE":GOSUB127
:IFBL=1THENBL=2ELSEBL=1
71 GOTO84
72 GOSUB54
73 IFRND(2)=1THEN74ELSE77
74 PRINT" HEADS IT IS !!":GOSUB1
26
75 IFG$="H"THENBL=1ELSEBL=2
76 GOTO79
77 PRINT" TAILS IT IS !!":GOSUB1
26
78 IFG$="T"THENBL=1ELSEBL=2
79 PRINTN$(BL);" WINS THE TOSS":
PRINT"WILL YOU <K>ICK OR <R>ECEI
VE ?"
80 G$=INKEY$:IFG$=""THEN80
81 IFG$="K"THEN84
82 IFG$<>"R"THEN80
83 IFBL=1THENBL=2ELSEBL=1
84 S(1)=0:S(2)=0:TQ=1:TM=15:TS=0
:YF=10:YT=0:L=1:DN=1:FLAG=BL:Q(1
)=3:Q(2)=3
85 L$(1)="DIVE":L$(2)="TRAP":L$(
3)="SWEEP":L$(4)="REVERSE":L$(5)
="TIGHT END SLANT":L$(6)="SIDELI
NE CURL":L$(7)="FLY":L$(8)="5-3
MAN-TO-MAN"
86 L$(9)="4-4 ZONE":L$(10)="5-3
ZONE STRONG SIDE":L$(11)="4-4 BL
ITZ":L$(12)="PREVENT"
87 CLS:PRINT@33,N$(1);:PRINT@47,
S(1);:PRINT@53,"QUARTER ";TQ;
88 IFTS>9THENM$=STR$(TS)ELSEM$="
0"+STR$(TS)
89 M$=STR$(TM)+":"+M$
90 PRINT@65,N$(2);:PRINT@79,S(2)
;:PRINT@85,M$
91 PRINT@130,DN;" DOWN  ";
92 IFYF<>-1THENPRINT@140,YF;"YAR
DS TO GO"ELSEPRINT@140,"GOAL TO
GO"
93 PRINTSTRING$(32,"-")
94 IFL=1THENPRINTN$(BL)+" KICKIN
G OFF"
95 IFL=3THENPRINTN$(BL)+" EXTRA
POINT TRY"
96 IFL=2THEN99
97 GOSUB129
```

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```
98 IFFLAG=-1THEN101ELSE106
99 GOSUB107:PRINTN$(BL)+" BALL":
PRINTY$
100 GOTO97
101 PRINT@354," THE GAME IS OVER
";
102 IFS(1)>S(2)THENPRINT@420,N$(
1)+" IS THE WINNER"
103 IFS(2)>S(1)THENPRINT@420,N$(
2)+" IS THE WINNER"
104 IFS(2)=S(1)THENPRINT@420," T
HE GAME ENDS IN A TIE !!"
105 END
106 ONLGOTO134,213,357
107 YL=INT(YL)
108 IFYL<=-60THEN117
109 IFYL<-50THEN118
110 IFYL=-50THEN119
111 IFYL<0THEN120
112 IFYL=0THEN121
113 IFYL<50THEN122
114 IFYL=50THEN123
115 IFYL<60THEN124
116 IFYL>=60THEN125
117 Y$="OUT OF THE "+N$(1)+"
          END ZONE":RETURN
118 Y$=STR$(ABS(YL)-50)+" YARDS
DEEP IN THE
  "+N$(1)+" END ZONE":RETURN
119 Y$="ON THE "+N$(1)+"
   GOAL LINE":RETURN
120 Y$="ON THE "+N$(1)+"
          "+STR$(50+YL)+" YARD L
INE":RETURN
121 Y$="ON THE 50-YARD LINE":RET
URN
122 Y$="ON THE "+N$(2)+"
          "+STR$(50-YL)+" YARD
LINE":RETURN
123 Y$="ON THE "+N$(2)+"
  GOAL LINE":RETURN
124 Y$=STR$(ABS(YL)-50)+" YARDS
DEEP IN THE                 "
+N$(2)+" END ZONE":RETURN
125 Y$="OUT OF THE "+N$(2)+"
          END ZONE":RETURN
126 FORDL=1TO500:NEXT:RETURN
127 FORDL=1TO1500:NEXT:RETURN
128 FORDL=1TO2000:NEXT:RETURN
129 IFMD=0THENGOTO127
130 IFMD<>0THENPRINT@449,"PRESS
ANY KEY"
131 PRINT@449,"":G$=INKEY$
132 IFG$=""THEN130ELSERETURN
133 REM 1000=KO,2000=SCR,3000=XP
134 YL=10:IFRU=1THENYL=15
135 IFK=99THENYL=30
136 K=0
137 IFBL=1THENYL=-1*YL
138 IFMD=0THEN142
139 IFMD=2THEN143
140 IFBL=1THENGOSUB157ELSEGOSUB1
61
141 GOTO144
142 GOSUB161:GOTO144
143 GOSUB157
144 CLS
145 GOSUB107
146 PRINT"THE BALL IS "+Y$
147 PRINTN$(BL)+" KICKING OFF"
148 PLAY"V31T202L10CEGO3CP10O2L2
0GO3L2C":GOSUB127
149 IFBL=1THENBT=2ELSEBT=1
150 ONZN+1GOTO151,154
151 KL=30+RND(SR(BL,5)*20)+RND(1
0):KL=INT(KL)
152 IFKL>70THENKL=70
153 GOTO164
154 KL=15:KL=KL+RND(SR(BL,5)*10)
+RND(5):KL=INT(KL)
155 IFKL>70THENKL=70
156 GOTO164
157 GOSUB126:CLS:PRINTN$(BL):PRI
NT"CHOOSE ONSIDES KICK?(Y/N)":PR
INT:PRINT
158 G$=INKEY$:IFG$=""THEN158
159 IFG$="Y"THENZN=1ELSEZN=0
160 RETURN
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```
161 ZN=Ø:IFTQ=4ANDBL=1ANDS(2)-S(
1)>7THENZN=1
162 IFTQ=4ANDBL=2ANDS(1)-S(2)>7T
HENZN=1
163 RETURN
```




```
164 CLS:PRINT"BALL TRAVELS ";KL;
" YARDS":IFBL=1THENYL=YL+KLELSEY
L=YL-KL
165 GOSUB1Ø7:PRINT"KICK TAKEN "+
Y$
166 GOSUB127
167 IFABS(YL)>=6ØTHEN178
168 IFABS(YL)<6ØANDABS(YL)>49THE
N182
169 IFBL=1THENBL=2ELSEBL=1
17Ø RL=Ø:FORI=1TO15:RL=RL+RND(43
):NEXTI
171 RL=INT(RL/16)+(SR(BL,5)-SR(B
T,5))*RND(8)
172 RL=INT(RL)
173 I=RND(1Ø+SR(BL,5))
174 IFI=1ANDZN=ØTHENRL=-1
175 IFI<4ANDZN=1THENRL=-1
176 CLS
177 GOTO189
178 IFBL=1THENBL=2ELSEBL=1
179 YL=-3Ø:IFBL=2THENYL=3Ø
18Ø PRINT"TOUCHBACK .. BALL GOES
 TO 2Ø":GOSUB127:TP=Ø:GOSUB422
181 DN=1:L=2:YF=1Ø:YT=8Ø:TP=7:GO
SUB422:GOTO87
182 IFMD=ØTHEN178
183 IFBL=1THENBL=2ELSEBL=1
```


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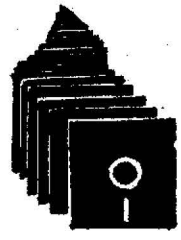
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```
184 IFMD=1ANDBL=1THEN186
185 IFMD=1ANDBL=2THEN179
186 PRINTN$(BL):PRINT" CHOOSE TO
 RUN THE BALL OUT?          (Y/N)"
187 G$=INKEY$:IFG$=""THEN187
188 IFG$="Y"THEN170ELSE179
189 IFRL=-1THEN203
190 IFBL=1THENYL=YL+RLELSEYL=YL-
RL
191 IFBL=1ANDYL>=50THEN200
192 IFBL=2ANDYL<=-50THEN200
193 IFBL=1ANDYL<-50THEN179
194 IFBL=2ANDYL>50THEN179
195 DN=1:L=2:YF=10:IFBL=1THENYT=
50-YLELSEYT=50+YL
196 IFYT<11THENYF=-1
197 PRINT:PRINT:PRINTN$(BL)+" RE
TURNS IT ":PRINTRL;" YARDS AND I
S DOWN"
198 GOSUB107:PRINTY$:GOSUB128
199 TP=24:GOSUB422:GOTO87
200 PRINTN$(BL)+" BREAKS A TACKL
E                    GOES ALL THE WA
Y":GOSUB126
201 GOSUB462
202 S(BL)=S(BL)+6:YF=10:DN=1:L=3
:TP=27:GOTO87
203 FORI=1TO8:CLS(I):SOUNDRND(25
5),1:NEXTI:CLS:PRINT:PRINT"FUMBL
E...":GOSUB127
204 IFYL>49ANDBL=2THEN212
205 IFBL=1THENPRINTN$(2)+" RECOV
ERS!"ELSEPRINTN$(1)+" RECOVERS!"
206 SOUND250,13:GOSUB127
207 TP=20:GOSUB422:DN=1:L=2:YF=1
0
208 IFBL=1THENBL=2ELSEBL=1
209 IFBL=1THENYT=50-YLELSEYT=50+
YL
210 IFYT<11THENYF=-1
211 GOTO87
212 PRINT" IN THE END ZONE..TOUC
HBACK":GOTO179
213 IFBL=1THENYT=50-YLELSEYT=50+
YL
214 IFBL=1THENBT=2ELSEBT=1
215 IFBL=1ANDMD<>0THEN226
216 IFBL=2ANDMD=2THEN226
217 ONDNGOTO218,220,222,224
218 IFTQ=4ANDT<30ANDYT<40ANDS(BT
)-S(BL)<3THENPO=9ELSEPO=RND(7)
219 GOTO234
220 IFTQ=4ANDT<30ANDYT<40ANDS(BT
)-S(BL)<3THENPO=9ELSEIFYF>10THEN
PO=RND(3)+4ELSEPO=RND(7)
221 GOTO234
222 IF(TQ=4ORTQ=2)ANDT<30ANDYT<4
0THENPO=9ELSEIFYF>6THENPO=RND(3)
```




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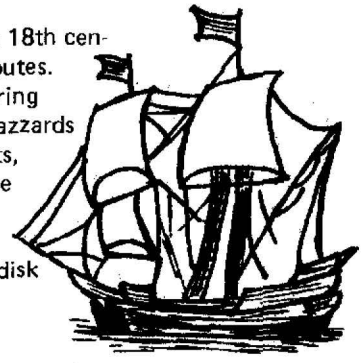
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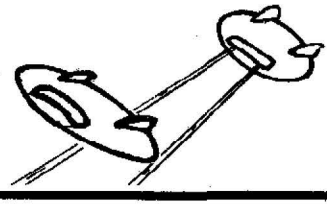
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New addition. User friendly directory Zapper to manually correct directory data when all else fails. Menu-driven with help files for novices.

```
+4ELSEPO=RND(4)
223 GOTO234
224 K=S(BT)-S(BL):IF(TQ=4ANDK>3A
NDYT<40)OR(TQ=4ANDK>3ANDYT<90AND
TM<2ANDYT>40)OR(YF<3ANDYT<20ANDK
>3)THENPO=1+RND(6)ELSEIF(TQ=4AND
K<4ANDK>0ANDYT<40)OR(TQ=2ANDK<8A
NDK>0ANDYT<40)OR(YT<37)THENPO=9E
LSEPO=8
225 GOTO234
226 CLS
227 PRINT
228 PRINTN$(BL):PRINT"SELECT OFF
ENSIVE PLAY":PRINT:PRINT"1=DIVE
          s=SAVE":PRINT"2=TRAP
        T=TIMEOUT"
229 PRINT"3=SWEEP":PRINT"4=REVER
SE":PRINT"5=SLANT PASS":PRINT"6=
CURL PASS":PRINT"7=FLY":PRINT"8=
PUNT":PRINT"9=FIELD GOAL"
230 G$=INKEY$:IFG$=""THEN230
231 PRINT@416,"*"
232 IFG$="s"THEN525ELSEIFG$="T"T
HEN406ELSEIFVAL(G$)<1ORVAL(G$)>9
THEN230ELSEPO=VAL(G$)
233 GOTO234
234 IFBL=2ANDMD<>0THEN237
235 IFBL=1ANDMD=2THEN237
236 GOTO244
```


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```
237 CLS:PRINT:PRINTN$(BT):PRINT:
PRINT
238 PRINT"SELECT DEFENSIVE PLAY"
:PRINT:PRINT"1 = 5-3  MAN-TO-MAN
":PRINT"2 = 4-4 ZONE"
239 PRINT"3 = 5-3 ZONE STRONG SI
DE":PRINT"4 = 4-4 BLITZ
s=SAVE":PRINT"5 = PREVENT
    T=TIMEOUT"
240 G$=INKEY$:IFG$=""THEN240
241 IFG$="s"THEN525ELSEIFG$="T"T
HEN407ELSEIFVAL(G$)<1ORVAL(G$)>5
THEN240ELSEPD=VAL(G$)
242 PRINT@416,"*"
243 GOTO246
244 IFTQ=4ANDS(BT)-S(BL)<6ANDT<1
30ANDYT<50THENPD=5ELSEIFDN=3ANDY
F>5THENPD=RND(3)+1ELSEPD=RND(4)
245 GOTO246
246 IFPO=8THEN247ELSEIFPO=9THEN2
75ELSE290
247 CLS:PRINTN$(BL)+" IN DEEP PU
NT                FORMATION":GOS
UB127:I=RND(10):IFI=7THEN248ELSE
259
248 IFBL=1THENYL=YL-15ELSEYL=YL+
15
249 IFBL=1THENBL=2ELSEBL=1
250 IFABS(YL)>=50THEN255
251 DN=1:L=2:TP=10+RND(20):GOSUB
422
252 PRINT"THE KICK IS BLOCKED !!
":PRINTN$(BL)+" RECOVERS":SOUND2
50,13:GOSUB127
253 YF=10:IF(BL=1ANDYL>40)OR(BL=
2ANDYL<-40)THENYF=-1
254 GOTO87
255 PRINT"THE KICK IS BLOCKED !"
:PRINTN$(BL)+" RECOVERS IN THE E
ND ZONE":PRINT"  IT'S A TOUCHDOW
N!!"
256 GOSUB462
257 S(BL)=S(BL)+6:DN=1:L=3:TP=10
+RND(15):GOSUB422
258 GOTO87
259 KL=RND(8)+7:KL=INT(KL*5)
260 PRINT"THE KICK IS AWAY":GOSU
B127
261 IFBL=1THENYL=YL+KLELSEYL=YL-
KL
262 IFBL=1THENBL=2ELSEBL=1
263 IFABS(YL)>=50THEN179
264 I=RND(5):IFI=3THEN265ELSE268
265 PRINT"FAIR CATCH CALLED":GOS
UB126:PRINTN$(BL)+" TAKES OVER":
GOSUB126
266 DN=1:L=2:TP=10+RND(20):GOSUB
422
267 GOTO253
268 GOSUB107:PRINTN$(BL)+" FIELD
```



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```
S THE BALL":PRINTY$:PRINT"AND RU
NS LEFT"
269 I=RND(8):IFI=8THENRL=55ELSEI
FI=7THENRL=80ELSERL=RND(20)
270 IFBL=1THENYL=YL+RLELSEYL=YL-
RL
271 IFABS(YL)>=50THEN274
272 DN=1:L=2:TP=15+RND(20):GOSUB
422:GOSUB107
273 PRINT"HE RETURNS IT TO":PRIN
TY$:GOSUB127:GOTO253
274 PRINT"HE'S GOT BLOCKERS":GOS
UB126:PRINT"HE'S GOING ALL THE W
AY !!":GOSUB126:GOTO201
275 IFBL=1THENRL=17+50-YLELSERL=
17+50+YL
276 CLS:PRINT"A ";RL;" YARD FIEL
D GOAL TRY":I=RND(11):IFI=7THEN2
48ELSE277
277 KL=SR(BL,5)+20+RND(10):KL=IN
T(KL)
278 I=ABS(YL)+KL:IFI>=50THEN279E
LSE285
279 PRINT"THE KICK IS UP...":GOS
UB127:PRINT"AND IT'S GOOD !!!"
280 CLS5:GOSUB463
281 YF=10:S(BL)=S(BL)+3:DN=1:L=1
:GOSUB126
282 IFRU=1THENYL=15ELSEYL=10
283 IFBL=1THENYL=INT(-1*YL)
284 GOTO87
285 PRINT"THE KICK IS UP...":GOS
UB126:PRINT"AND IT'S WIDE ... NO
 GOOD.":SOUND250,13:GOSUB127
286 IF(BL=1ANDYL>30)OR(BL=2ANDYL
<-30)THEN178
287 IFRU=1THEN178ELSE288
288 DN=1:TP=18:GOSUB422:YF=10:L=
2:IFBL=1THENBL=2ELSEBL=1
289 GOTO87
290 YL=YL
291 IFBL=1THENBT=2ELSEBT=1
292 CLS:IFPD<>4THENPRINTN$(BT)+"
 LINES UP IN A          "+L$(PD+7)
ELSEPRINTN$(BT)+" LINES UP IN A
      4-4 MAN-TO-MAN"
293 GOSUB126:IFPO<5THENPRINTN$(B
L)+" RUNS A "+L$(PO)ELSEPRINTN$(
BL)+" DROPS BACK TO PASS"
294 GOSUB126:IFPO<5THEN295ELSEPR
INT"IT'S A "+L$(PO)
295 GOSUB126:IFPO>4ANDPD=4THENPR
INT"THEY'RE COMING WITH A BLITZ!
"
296 GOSUB440
297 IFK=200THEN301
298 IFK=100THEN315
299 J=RND(50):IFABS(YL)<45AND(J=
```


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```
370RJ=38)THEN409
300 IFK<0THEN344ELSE324
301 IFPO=7THENKL=RND(5)*10ELSEKL
=RND(3)*10
302 KL=INT(KL):PRINT"HE DELIVERS
":GOSUB126:PRINT"IT'S GOING AT L
EAST ";10*INT(KL/10);" YARDS"
303 PRINT"IT'S INTERCEPTED !!":G
OSUB127
304 IFBL=1THENYL=YL+KLELSEYL=YL-
KL
305 IFBL=1THENBL=2ELSEBL=1
306 IFABS(YL)>=50THEN179
307 RL=RND(2)*10+RND(10):IFRL=15
THENRL=65
308 IFBL=1THENYL=YL+RLELSEYL=YL-
RL
309 IFABS(YL)>=50THEN200
310 DN=1:L=2:TP=20+RND(20):YF=10
311 IFBL=1ANDYL>40THENYF=-1
312 IFBL=2ANDYL<-40THENYF=-1
313 PRINT:PRINTN$(BL):PRINT" RET
URNS IT ";RL;" YARDS "
314 SOUND250,13:GOSUB127:GOSUB42
2:GOTO87
315 FORI=1TO8:CLS(I):SOUNDRND(25
5),1:NEXTI:CLS:PRINT" F U M B L
E !":GOSUB127
316 IFPO<=4THENKL=RND(10)ELSEKL=
RND(25)
317 IFBL=1THENYL=YL+KLELSEYL=YL-
KL
318 IFABS(YL)>=50THEN322
319 IFBL=1THENBL=2ELSEBL=1
320 L=2:DN=1:PRINTN$(BL)+" GETS
THE BALL !":TP=10+RND(5):YF=10:G
OSUB127
321 GOTO87
322 PRINT"THE BALL WAS PAST THE
PLANE OF       THE GOAL LINE":GOS
UB127
323 GOTO201
324 IFK=0ANDPO>4THENPRINT" THE P
ASS IS INCOMPLETE"
325 GOSUB127
326 IFBL=1THENYL=YL+KELSEYL=YL-K
327 IFABS(YL)>=50THEN341
328 SOUND250,13:IFK<>0THENPRINT"
 IT'S A GAIN OF";K;" YARDS"ELSEP
RINT" NO GAIN ON THE PLAY"
329 GOSUB127
330 IFYF<>-1ANDK>=YFTHEN335
331 IFYF<>-1THENYF=YF-KELSEYF=-1
332 DN=DN+1:IFDN>4THEN338
333 L=2:TP=RND(20)+10:GOSUB422
334 GOTO87
335 DN=1:YF=10:IF(BL=1ANDYL>=40)
OR(BL=2ANDYL<=-40)THENYF=-1
336 TP=12+RND(20):GOSUB422:GOSUB
470
337 L=2:GOTO87
338 PRINT"BALL GOES OVER ON DOWN
S":GOSUB127
339 IFBL=1THENBL=2ELSEBL=1
340 GOTO335
341 IFYF<>-1THEN342ELSE343
342 PRINTN$(BL)+" BREAKS INTO TH
E       SECONDARY":GOSUB126:PRIN
T"HE'S GOING TO GO ALL THE WAY!"
:GOSUB126:GOTO201
343 PRINTN$(BL)+" IS IN THERE!":
GOSUB126:GOTO201
344 IFBL=1THENYL=YL+KELSEYL=YL-K
345 IFABS(YL)>49THEN352ELSE346
346 IFDN=4THEN338
347 IFYF<>-1THENYF=YF-KELSEYF=-1
348 DN=DN+1:L=2:TP=10+RND(20):GO
SUB422
349 IFPO>4THENPRINT"THE QUARTERB
ACK IS IN TROUBLE"
350 GOSUB126:IFPO>4THENPRINT"HE'
S SACKED !"
351 SOUND250,13:PRINT"IT'S A LOS
S OF ";ABS(K);" YARDS":GOSUB127:
GOTO87
352 IFPO>4THENPRINT"THE QUARTERB
ACK IS DROPPING BACKINTO THE END
 ZONE    HE'S HIT    AND SACKED
FOR A SAFETY"ELSEPRINT"HE'S HIT
```


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```
HARD AND DRIVEN BACK   FOR A SAF
ETY !!"
353 GOSUB127
354 IFBL=1THENS(2)=S(2)+2ELSES(1
)=S(1)+2
355 DN=1:YF=10:L=1:TP=10+RND(5):
GOSUB422
356 K=99:GOTO87
357 YL=YL:REM EXTRA POINT
358 IFBL=1ANDMD=1THEN376
359 IFMD=0THEN380
360 IFBL=2ANDMD=1THEN380
361 IFPO=3THEN369
362 IFBL=2ANDMD=1THEN384
363 IFMD=0THEN389
364 IFBL=1ANDMD=1THEN389
365 IFPO=3THEN369
366 IFPO=1THEN390
367 IFPO=2THEN394
368 GOTO358
369 CLS:PRINT"THE KICK FOR THE E
XTRA POINT":GOSUB126:PRINT"THE K
ICK IS UP...":I=RND(10):IFI=5THE
N373ELSE370
370 GOSUB127:PRINT" AND IT'S GOO
D !!"
371 GOSUB126
372 S(BL)=S(BL)+1:YF=10:YT=0:L=1
:DN=1:GOTO87
```


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```
373 GOSUB127:PRINT" AND IT'S WID
E !!  NO GOOD."
374 GOSUB126
375 YF=10:YT=0:L=1:DN=1:GOTO87
376 CLS:PRINTN$(BL)+" CHOOSE OFF
ENSIVE PLAY":PRINT:PRINT:PRINT"K
=KICK":PRINT"R=RUN":PRINT"P=PASS
"
377 G$=INKEY$:IFG$=""THEN377
378 IFG$="R"THENPO=1ELSEIFG$="K"
THENPO=3ELSEIFG$="P"THENPO=2ELSE
GOTO377
379 GOTO361
380 IFBL=1THENBT=2ELSEBT=1
381 IFRU=1THEN382ELSEIFTQ=4AND(S
(BT)-S(BL)=1ORS(BT)-S(BL)=2)THEN
383
382 PO=3:GOTO361
383 PO=RND(2):GOTO361
384 CLS:IFBL=1THENBT=2ELSEBT=1
385 PRINTN$(BT)+" CHOOSE DEFENSI
VE PLAY":PRINT:PRINT:PRINT"R=RUN
":PRINT"P=PASS"
386 G$=INKEY$:IFG$=""THEN386
387 IFG$="R"THENPD=1ELSEIFG$="P"
THENPD=2ELSEGOTO386
388 GOTO365
389 PD=RND(2):GOTO365
390 CLS:PRINT"THE BALL IS SNAPPE
D":PRINT"SWEEP AROUND LEFT END":
GOSUB126
391 IFPD=1THENI=RND(10)
392 IFPD=2THENI=RND(5)
393 IFI>4THEN402ELSE398
394 CLS:PRINT"THE BALL IS SNAPPE
D":PRINT"QUARTERBACK ROLLS RIGHT
":GOSUB126:PRINT"   AND FIRES A
PASS":GOSUB126
395 IFPD=2THENI=RND(10)
396 IFPD=1THENI=RND(5)
397 IFI>4THEN402ELSE398
398 IFPO=1THENPRINT" HE'S IN THE
 END ZONE          IT'S GOOD !!"
399 IFPO=2THENPRINT" COMPLETE !!
 IT'S GOOD"
400 GOSUB127
401 S(BL)=S(BL)+RU:YF=10:YT=0:L=
1:DN=1:GOTO87
402 IFPO=1THENPRINT"HE'S HIT AND
 IS SHORT!"
403 IFPO=2THENPRINT"IT'S DEFLECT
ED .. NO GOOD"
404 GOSUB127
405 YF=10:YT=0:L=1:DN=1:GOTO87
406 FT=BL:GOTO226
407 IFBL=1THENFT=2ELSEFT=1
408 GOTO237
409 SOUND250,13:J=RND(2)
410 CLS:PRINT@132,"A FLAG IS DRO
PPED":PRINT:PRINT:GOSUB126:PRINT
```

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```
" A PENALTY AGAINST "+N$(J)
411 GOSUB127:K=5+RND(2)*5:PRINT
412 IFK=5THENPRINT"ILLEGAL PROCE
DURE"ELSEIFK=10THENPRINT"HOLDING
"ELSEIFK=15THENPRINT"UNSPORTSMAN
LIKE CONDUCT"
413 PRINT"                IS THE CALL
":GOSUB127
414 IFJ=1THENI=50+YLELSEI=50-YL
415 IFK>INT(I/2)THENK=INT(I/2)
416 IFBL=JTHENYF=YF+KELSEYF=YF-K
417 IFYF<=0THEN420
418 IFJ=1THENYL=YL-KELSEYL=YL+K
419 GOTO87
420 IFJ=1THENYL=YL-KELSEYL=YL+K
421 GOTO335
422 IFFT=1ORFT=2THENTP=10
423 IFFT<>0ANDQ(FT)=0THEN431
424 IFFT<>0THENQ(FT)=Q(FT)-1
425 IFFT<>0THENPRINTN$(FT)+" HAS
                  ";Q(FT);" TIMEO
UT(S) LEFT"
426 GOSUB126
427 T=INT(60*TM+TS)-TP-RND(16):F
T=0
428 IFT<=0THEN432
429 TM=INT(T/60):TS=INT(T-TM*60)
430 RETURN
431 TP=20+RND(15):PRINTN$(FT)+"
HAS NO TIMEOUTS           LEFT":
GOSUB127:GOTO427
432 SOUND10,10:ONTQGOTO434,435,4
38,439
433 TQ=4:FLAG=-1:GOTO432
434 CLS:PRINT@64,"END OF FIRST Q
UARTER":GOSUB127:TQ=2:TM=15:TS=0
:RETURN
435 GOSUB479:TQ=3:TM=15:TS=0:YF=
10:YT=0:L=1:DN=1:Q(1)=3:Q(2)=3
436 IFFLAG=1THENBL=2ELSEBL=1
437 RETURN
438 CLS:PRINT@161,"END OF THIRD
QUARTER":GOSUB127:TQ=4:TM=15:TS=
0:RETURN
439 TQ=4:TM=0:TS=0:SOUND10,12:FL
AG=-1:GOTO87
440 RESTORE
441 IFBL=1THENBT=2ELSEBT=1
442 K=RND(20)
443 I=0
444 ONKGOTO445,446,446,447,447,4
48,448,448,448,449,449,449,449,4
49,450,450,450,450,450,450
445 I=I+1
446 I=I+1
447 I=I+1
448 I=I+1
449 I=I+1
450 I=I+1
451 N=INT((PD-1)*42+(PO-1)*6+I)
452 FORI=1TON:READK:NEXTI
453 IFPO<=4THEN458
454 IFK=0ORK=100ORK=200THENRETUR
N
455 I=SR(BL,2)-SR(BT,4)
456 K=INT(K+10*I*(RND(2)/2))
457 RETURN
458 IFK=100ORK=200THENRETURN
459 I=SR(BL,1)-SR(BT,3):IFI<0THE
NI=I/2
460 K=INT(K+4*I*(RND(2)/2))
461 RETURN
462 CLS5:PRINT@69,STRING$(21," "
);:PRINT@101," T O U C H D O W N
 ! ";:PRINT@133,STRING$(21," ");
463 PRINT@269,CHR$(202);CHR$(206
);CHR$(205);CHR$(197);
464 PRINT@301,CHR$(203);CHR$(192
);CHR$(192);CHR$(199);
465 PRINT@334,CHR$(192);CHR$(192
);
466 PRINT@366,CHR$(197);CHR$(202
);
467 PRINT@398,CHR$(197);CHR$(202
);
468 PLAY"T403L4AP16L2AL4GFL4CL3C
L4DFB-AP4FG04L4DC03AB-AAGL3B-L8A
L2F"
469 GOSUB127:RETURN
```


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```
470 CLS5:PRINT@68,STRING$(23," "
);:PRINT@100,"     ";N$(BL);"
   ";:PRINT@132," F I R S T   D
O W N ! ";:PRINT@164,STRING$(23,
" ");
471 PRINT@270,CHR$(196);CHR$(205
);
472 PRINT@238,CHR$(205);
473 PRINT@302,CHR$(192);CHR$(192
);CHR$(195);CHR$(199);
474 PRINT@334,CHR$(192);CHR$(192
);
475 PRINT@366,CHR$(197);CHR$(202
);
476 PRINT@398,CHR$(197);CHR$(202
);
477 GOSUB127
478 RETURN
479 CLS(7):PRINT@70," H A L F T
I M E ";
480 FORI=256TO479:PRINT@I,CHR$(1
43);:NEXT
481 PRINT@299,CHR$(129);CHR$(131
);CHR$(131);CHR$(143);CHR$(129);
CHR$(131);CHR$(130);
482 PRINT@331,CHR$(133);CHR$(142
);CHR$(140);CHR$(143);CHR$(133);
CHR$(143);CHR$(138);
483 PRINT@363,CHR$(132);CHR$(140
);CHR$(136);CHR$(143);CHR$(132);
CHR$(140);CHR$(136);
484 PRINT@417,N$(1);" ";S(1)
485 PRINT@449,N$(2);" ";S(2);
486 PLAY"T402L4AP16A-AB-L3B-L4AL
2B-P4L4B-B-P16B-AB-03CL3CL402BL2
03CP403L4DFEDC02AFGA03L3C02L8B-L
4AGL2F"
487 GOSUB127:GOSUB127:GOSUB127
488 RETURN
489 CLS(8)
490 PRINT@38," S T R A T E G Y "
;:PRINT@106," F O O T B A L L ";
491 PRINT@168," BY  R.K. TYSON "
;
492 PRINT@230,CHR$(254);STRING$(
18,CHR$(252));
493 FORI=262TO359STEP32
494 PRINT@I,CHR$(250);CHR$(239);
495 FORK=1TO5
496 J=I+2+(K-1)*3
497 PRINT@J,CHR$(133);CHR$(138);
CHR$(143);
498 NEXTK
499 PRINT@I+17,CHR$(181);CHR$(18
6);
500 NEXTI
501 PRINT@390,CHR$(251);STRING$(
18,CHR$(243));
```

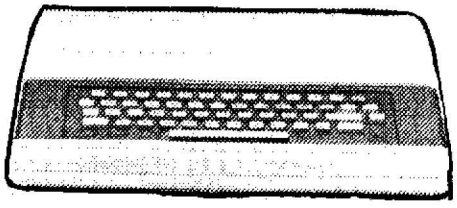



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```
502 PRINT@449,"DO YOU WANT A SAV
ED GAME(Y/N)?";
503 G$=INKEY$:IFG$=""THEN503ELSE
IFG$="Y"THEN504ELSEIFG$="N"THEN1
0ELSE503
504 CLS:PRINT@64,"ENTER":PRINT"1
 = DISK":PRINT"2 = TAPE"
505 INPUTK
506 IFK=1ORK=2THEN508ELSE507
507 PRINT"INVALID ENTRY .. TRY A
GAIN":GOSUB127:GOTO504
508 IFK=1THENK=1ELSEK=-1
509 IFK=-1THENPRINT"INSERT TAPE;
 PRESS <PLAY>;        PRESS <ENTER
> WHEN READY"
510 IFK=-1THENGOSUB524
511 CLS:IFK=1THENPRINT"ENTER FIL
ENAME/EXT:DRIVE"ELSEPRINT"ENTER
FILENAME"
512 INPUTG$
513 IFK=1THEN!ON
514 OPEN"I",#K,G$
515 INPUT#K,S(1),S(2)
516 FORI=1TO2:FORJ=1TO5:INPUT#K,
SR(I,J):NEXTJ,I
517 INPUT#K,N$(1),N$(2)
518 FORI=1TO12:INPUT#K,L$(I):NEX
TI
519 INPUT#K,BL,RU,MD,YL,TQ,TM,TS
,TP
520 INPUT#K,YF,YT,FT,L,ZN,DN,BT,
FL,Q(1),Q(2)
521 IFK=1THEN!OFF
522 CLOSE#K
523 GOTO87
524 G$=INKEY$:IFG$=""THEN524ELSE
RETURN
525 CLS:PRINT@64,"ENTER":PRINT"1
 = DISK":PRINT"2 = TAPE"
526 INPUTK
527 IFK=1ORK=2THEN529ELSE528
528 PRINT"INVALID ENTRY .. TRY A
GAIN":GOSUB127:GOTO525
529 IFK=1THENK=1ELSEK=-1
530 IFK=-1THENPRINT"INSERT TAPE;
 PRESS <RECORD>;     PRESS <ENTER
> WHEN READY"
531 IFK=-1THENGOSUB524
532 CLS:IFK=1THENPRINT"ENTER FIL
ENAME/EXT:DRIVE"ELSEPRINT"ENTER
FILENAME"
533 INPUTG$
534 IFK=1THEN!ON
535 OPEN"O",#K,G$
536 PRINT#K,S(1),S(2)
537 FORI=1TO2:FORJ=1TO5:PRINT#K,
SR(I,J):NEXTJ,I
538 PRINT#K,N$(1)
539 PRINT#K,N$(2):FORI=1TO12:PRI
NT#K,L$(I):NEXTI
540 PRINT#K,BL,RU,MD,YL,TQ,TM,TS
,TP
541 PRINT#K,YF,YT,FT,L,ZN,DN,BT,
FL,Q(1),Q(2)
542 CLOSE#K
543 IFK=1THEN!OFF
544 GOTO87
545 DATA 1,2,3,-2,16,100,1,7,5,-
2,15,100,-4,6,8,12,100,30,15,2,-
5,45,100,-13,0,15,7,0,25,200,4,0
,6,-6,200,12,34,0,0,200,-9,200
546 DATA 0,3,1,2,-3,100,8,5,3,-2
,100,27,8,6,17,-3,56,100,0,2,-6,
18,100,-20,17,-6,200,0,0,28,7,0,
-5,4,0,200,-7,0,200,0,49,-7
547 DATA 0,1,2,3,-3,100,-2,4,5,-
4,100,19,5,-1,0,2,14,100,7,34,1,
-9,100,-22,6,17,0,31,200,57,5,8,
0,3,-12,200,10,0,48,32,-15,200
548 DATA 1,-2,7,1,4,100,-2,3,5,-
3,5,100,5,-5,2,40,-17,100,2,1,-1
5,4,100,16,25,0,-9,37,8,200,20,5
,0,200,46,-6,53,0,-11,200,-8,35
549 DATA 2,3,5,-1,8,100,5,7,12,1
,26,100,12,7,2,6,100,23,5,6,1,2,
100,34,18,0,15,200,47,0,5,0,7,20
0,0,16,0,0,68,200,2,7
550 PCLEAR1:GOTO7
```

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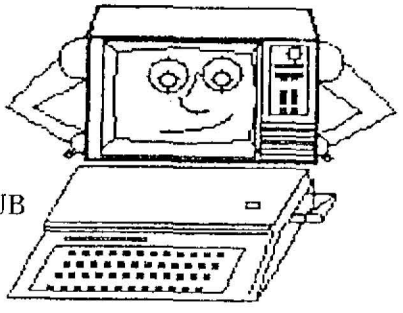
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10). FIND FRIENDS. As a new member, you will receive a list of the members in your area on a quarterly basis whom you may contact for CoCo talk.

HOW TO BECOME A MEMBER::::

Write to the club for an application, there are no conditions for membership other than agreeing to obey the rules and by-laws, being interested and paying the dues. The membership dues are $30.00 ($50.00 outside the U.S.(In Canada it is in Canadian funds) in U.S. funds)per year and we believe you get more than your moneys worth. You can save more than the memberhip dues in discounts the club offers to you. Example : Subscription to the RAINBOW, 25% off of the regular subscription rates. Some members have told me that the new member tape alone is worth the membership dues. It contains 10 very good programs. Some of the programs contained in the library are Accounts Receivable, General Ledger, Inventory, Sales File and ticket program with automatic Inventory update (for 32K with 2disk). There is over 72 programs in the library to choose from ranging from 4K to 64K w/disk.

VISA MasterCard

COLOR COMPUTER MEMORY MAP

By BOB RUSSELL

This is the second installment in a comprehensive series of references on the Color Computer memory, and covers BASIC and Extended BASIC ROM.

This memory map has been created after many hours of research, investigation and experimentation. I probably have over 650 hours already invested in this project and I know I am not finished. I fully intend to offer periodic updates to this document. My wish is that this will become a living, growing document that you will also contribute to. I hope you will bring any errors to my attention and also share any unmapped discoveries you may have made.

Among those publications offering the most accurate and reliable memory information are Radio Shack's Service Manual, *Color Computer News* and *the Rainbow*. If you refer to these resources you will often find detailed information (sometimes even a commented listing that can be matched to a disassembled listing to really describe what is going on!). Throughout the Map, I will refer to some of these resources.

An *S* indicates a ROM or RAM based routine that you could potentially call from your own assembly language program. $nnn is a notation for hexadecimal values.

Sources referred to in this map:

1) *Getting Started With Color* BASIC
Copyright 1981 Tandy Corp.
Fort Worth, TX 76102

2) *Going Ahead With Extended* BASIC
Copyright 1981 Tandy Corp.
Forth Worth, TX 76102

3) *Service Manual, TRS-80 Color Computer*
Catalog Number 26-3001/3002

4) *TRS-80 Microcomputer News*
(for TRS-80 users)
P.O. Box 2910
Forth Worth, TX 76113-2910

5) *Color Computer News*
REMarkable Software
P.O. Box 1192
Muskegan, MI 49443

6) *the Rainbow*
9529 U.S. Highway 42
P.O. Box 209
Prospect, KY 40059

7) *80 Micro*
80 Pine Street
Peterborough, NH 03458

If you don't want to cut up your *Rainbow* Magazine you may purchase copies of the Memory Map in its entirety, enclosed in an attractive cover, for $9 (Wisconsin residents should add five percent for sales tax.). I invite dealer and computer club volume purchases at discounted prices.

For making inquiries or placing orders, write: Bob Russell, N5474 Stillwater Court, Fredonia, WI 53021.

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```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                    Description
----- ---- ----- ----  ------------------------------------------------

32768 8000 40959 9FFF    EXTENDED BASIC ROM[1]

  33155 8183 33263 81EF    Extended BASIC Command keyword - token table -
                           ASCII Characters Ref. [7] December 1982 Anniversary
                           Issue
                                CONTAINS    CONVERTED TO
                                STRING      TOKEN
    33155 8183 33157 8185       DEL         $B5
    33158 8186 33161 8189       EDIT        $B6
    33162 818A 33165 818D       TRON        $B7
    33166 818E 33170 8192       TROFF       $B8
    33171 8193 33173 8195       DEF         $B9
    33174 8196 33176 8198       LET         $BA
    33177 8199 33180 819C       LINE        $BB
    33181 819D 33184 81A0       PCLS        $BC
    33185 81A1 33188 81A4       PSET        $BD
    33189 81A5 33194 81AA       PRESET      $BE
    33195 81AB 33200 81B0       SCREEN      $BF
    33201 81B1 33206 81B6       PCLEAR      $C0
    33207 81B7 33211 81BB       COLOR       $C1
    33212 81BC 33217 81C1       CIRCLE      $C2
    33218 81C2 33222 81C6       PAINT       $C3
    33223 81C7 33225 81C9       GET         $C4
    33226 81CA 33228 81CC       PUT         $C5
    33229 81CD 33232 81D0       DRAW        $C6
    33233 81D1 33237 81D5       PCOPY       $C7
    33238 81D6 33242 81D7       PMODE       $C8
    33243 81D8 33246 81DE       PLAY        $C9
    33247 81DF 33251 81E3       DLOAD       $CA
    33252 81E4 33255 81E8       RENUM       $CB
    33257 81E9 33258 81EA       FN          $CC
    33259 81EB 55263 81EF       USING       $CD

  33088 81F0 33309 821D    Table of Pointers to subroutine entry addresses
                           associated with Extended BASIC Command Keyword
                           Table defined at $8183 to $81EF, Ref. [7] December
                           1982 Anniversary Issue.

                                Contents    For Command
    33088 81F0                  $8970       DEL
    33090 81F2                  $8533       EDIT
    33092 81F4                  $86A7       TRON
    33094 81F6                  $86A8       TROFF
    33096 81F8                  $8871       DEF
    33098 81FA                  $AF89       LET
    33100 81FC                  $93BB       LINE
    33102 81FE                  $9532       PCLS
    33104 8200                  $9361       PSET
    33106 8202                  $9365       PRESET
    33108 8204                  $9670       SCREEN
    33110 8206                  $968B       PCLEAR
    33112 820B                  $9546       COLOR
    33114 820A                  $9E9D       CIRCLE
    33116 820C                  $98EC       PAINT
    33118 820E                  $9755       GET
```

```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                    Description
----- ---- ----- ----  ------------------------------------------------

32768 8000 40959 9FFF    EXTENDED BASIC ROM Cont. [1]

    33120 8210                  $9758       PUT
    33122 8212                  $9CB6       DRAW
    33124 8214                  $9723       PCOPY
    33126 8216                  $9621       PMODE
    33128 8218                  $9A22       PLAY
    33130 821A                  $8C1B       DLOAD
    33132 821C                  $8A09       RENUM

  33310 821E 33366 8256    Extended BASIC Function keyword - token table -
                           ASCII characters, Ref. [7] December 1982
                           Anniversary Issue.

                                CONTAINS    CONVERTED TO
                                STRING      TOKEN
    33310 821E 33312 8221       ATN         $FF94
    33313 8222 33315 8223       COS         $FF95
    33316 8224 33318 8226       TAN         $FF96
    33319 8227 33321 8229       EXP         $FF97
    33322 822A 33324 822C       FIX         $FF98
    33325 822D 33327 822F       LOG         $FF99
    33328 8230 33330 8232       POS         $FF9A
    33331 8233 33333 8235       SQR         $FF9B
    33334 8236 33337 8239       HEX$        $FF9C
    33338 823A 33343 823F       VARPTR      $FF9D
    33344 8240 33348 8244       INSTR       $FF9E
    33349 8245 33353 8249       TIMER       $FF9F
    33354 824A 33359 824F       PPOINT      $FFA0
    33360 8250 33366 8256       STRING$     $FFA1

  33367 8257 33394 8272    Table of Pointers to subroutine entry addresses
                           associated with Extended BASIC Function Keyword
                           Table defined at $821E to $8255, Ref. [7] Dec 1982
                           Anniversary Issue.

                                Contents    For Function
    33367 8257                  $83B0       ATN
    33369 8259                  $8378       COS
    33371 825B                  $8391       TAN
    33373 825D                  $84F2       EXP
    33375 825F                  $8524       FIX
    33377 8261                  $8446       LOG
    33379 8263                  $86AC       POS
    33381 8265                  $8480       SQR
    33383 8267                  $8BDD       HEX$
    33385 8269                  $86BE       VARPTR
    33387 826B                  $877E       INSTR
    33389 826D                  $8968       TIMER
    33391 826F                  $9339       PPOINT
    33393 8271                  $874E       STRING$

  33465 82B9 33566 831E    *S* Routine to look for BREAK or shift @ and do
                           some byte fetching after interpreter is done
                           with a BASIC statement Ref. [5] #6

  33467 82BB 33538 8302    *S* Interpret loop to enable trace function
```

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
32768	8000	40959	9FFF	EXTENDED BASIC ROM Cont. [1]
33656	8378			*S* Execution of "COS" Extended BASIC function (Token $FF95)
33665	8381			*S* Execution of "TAN" Extended BASIC function (Token $FF96)
33712	83B0			*S* Execution of "ATN" Extended Basic function (Token $FF94)
33862	8446			*S* Execution of "LOG" Extended BASIC function (Token $FF99)
33920	8480			*S* Execution of "SQR" Extended BASIC function (Token $FF98)
34034	84F2			*S* Execution of "EXP" Extended BASIC function (Token $FF97)
34084	8524			*S* Execution of "FIX" Extended BASIC function (Token $FF98)
34099	8533			*S* Execution of "EDIT" Extended BASIC command (Token $B6)
34115	8543			*S* Edit Routine
34471	86A7			*S* Execution of "TRON" Extended BASIC command (Token $B7)
34472	86A8			*S* Execution of "TROFF" Extended BASIC command (Token $B8)
34476	86AC			*S* Execution of "POS" Extended BASIC function (Token $FF9A)
34494	86BE			*S* Execution of "VARPTR" Extended BASIC function (Token $FF9D)
34638	874E			*S* Execution of "STRING$" Extended BASIC function (Token $FFA1)
34686	877E			*S* Execution of "INSTR" Extended BASIC function (Token $FF9E)
34929	8871			*S* Execution of "DEF" Extended BASIC command (Token $B9)
35176	8968			*S* Execution of "TIMER" Extended BASIC function (Token $FF9F)
35184	8970			*S* Execution of "DEL" Extended BASIC command (Token $B5)

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
32768	8000	40959	9FFF	EXTENDED BASIC ROM Cont. [1]
35337	8A09			*S* Execution of "RENUM" Extended BASIC command (Token $CB)
35805	8BDD			*S* Execution of "HEX$" Extended BASIC function (Token $FF9C)
35864	8C18	36282	8D8A	*S* Execution of "DLOAD" Extended BASIC command (Token $CA). DLOADM Ref [5] #13. Note experience has indicated DLOADM does not work, DLOAD does, will try to determine error later.
36284	8D8C			*S* Input RS232 character
36326	8DB6			*S* Get bit or timeout
36343	8DF7			*S* Delay one bit time
36358	8E06			*S* Send RS232 character
37519	928F	37772	938C	*S* Get line data and setup Graphics. Ref. [5] #8
37519	928F			Find byte/bit routine
37542	92A6			Set up for Pmodes 0,2,or 4
37570	92C2			Setup for Pmodes 1,or 3
37597	92DD			Table for 1 bit/point
37605	92E5			Table for 2 bit/point
37689	9339			*S* Execution of "PPOINT" Extended BASIC function (Token $FFA0)
37729	9361			*S* Execution of "PSET" Extended BASIC command (Token $BD)
37733	9365			*S* Execution of "PRESET" Extended BASIC command (Token $BE)
37819	93BB			*S* Execution of "LINE" Extended BASIC command (Token $BB)
37956	9444			*S* Draw Horizontal line. Ref. [5] #8
37996	946C			*S* Draw Vertical line. Ref. [5] #8
38049	94A1	38177	9521	*S* Draw sloped line routine. Ref. [5] #8

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
32768	8000	40959	9FFF	EXTENDED BASIC ROM Cont. [1]
	38114		94E2	Draw line loop
	38150		9506	Move right
	38157		950D	Move up
	38164		9514	Move left
	38171		951B	Move down
	38194		9532	*S* Execution of "PCLS" Extended BASIC command (Token $BC)
	38214		9546	*S* Execution of "COLOR" Extended BASIC command (Token $C1)
	38433		9621	*S* Execution of "PMODE" Extended BASIC command (Token $C8)
	38512		9670	*S* Execution of "SCREEN" Extended BASIC command (Token $BF)
	38539		968B	*S* Execution of "PCLEAR" Extended BASIC command (Token $C0)
	38672		9710	*S* Compare 2 point. Ref. [5] #8
	38691		9723	*S* Execution of "PCOPY" Extended BASIC command (Token $C7)
	38741		9755	*S* Execution of "GET" Extended BASIC command (Token $C4)
	38744		9758	*S* Execution of "PUT" Extended BASIC command (Token $C5)
	39148		98EC	*S* Execution of "PAINT" Extended BASIC command (Token $C3)
	39458		9A22	*S* Execution of "PLAY" Extended BASIC command (Token $C9)
	40118		9CB6	*S* Execution of "DRAW" Extended BASIC command (Token $C6)
	40605		9E9D	*S* Execution of "CIRCLE" Extended BASIC command (Token $C2)

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
40960	A000	49151	BFFF	BASIC ROM[1]
	40961		A000	Address of routine to poll keyboard for a character POLCAT[2] ($A1C1) Z=1,A=0 NO KEY Z=0,A=KEY FOR KEY
	40962		A002	Address of routine to Output char in REG A to current ouput device (all registers but CC are preserved) CHROUT[1] ($A2A7)
	40964		A004	Address of routine to start cassette-turns on motor and read header/gaps (gets into bit sync) CSRDON[2] ($A77C)
	40966		A006	Address of routine to read a block from cassette into tape buffer BLKIN[2], cassette must be on and in bit sync X=CBUFAD[2]+BLKLEN[2] interrupts are masked U and Y are preserved all others modified ($A76B)
	40968		A008	Address of routine to write a block to cassette from tape buffer BLKOUT[2] X=CBUFAD[2]+BLKLEN[2] all registers modified ($A7F4)
	40970		A00A	Address of routine to sample joystick pots and store their values in $15A (346) to $15D (349). Y is preserved all others modified JOYIN[1] ($A9DE)
	40972		A00C	Address of routine to turn cassette on and write leader/gap/ $55'S WRTLDR[2] ($A7D8)
	40974	41162	A0CA	Cold start routines
	40999		A027	*S* Performs reset when reset button is pressed
	41126		A0A6	Check for extended Disk ROM and branch; Basic ends up here after Extended Basic initializes and reconfigures the system to include Extended Basic functions. Then a check is made to see if Disk Basic ROM is present; if $C000 contains $44 and $C001 contains $4B then jump is made to $C002
	41163		A0CB	Check for extended Basic ROM and branch; Basic ends up here after completing cold start; a check is made to see if Extended Basic ROM is present; if $8000 contains $45 and $8001 contains $58 then jump is made to $8002.

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
40960	A000	49151	BFFF	BASIC ROM[1] Cont.
41175	A0D7			*S* Displays version of BASIC ROM $A000-$BFFF.
41192	A0E8			*S* Warm restart (pointers not reinitialized)
41206	A0F6			*S* Default FIRQ handler
41229	A10D			BASIC Initialization data
41286	A146	41328	A170	Logo text
41329	A171			*S* Get character from keyboard or cassette and put into REG. A. Set bit 8=0 and parity off
41334	A176			*S* Get character from keyboard or cassette and put into REG. A, no modification
41350	A186			*S* Get character from cassette and put into REG. A
41393	A1B1			*S* Display cursor and wait for input character from keyboard and put character into REG. A.
41409	A1C1			*S* Check for character at keyboard (8 bit =0 if character is not there; 8 bit =1 if character is there)
41606	A28F			*S* Send character in REG. A. to current output device
41730	A302			*S* Delay half bit time
41872	A390			*S* Line input
42006	A416			*S* Execution of "CLOSE" BASIC command (Token $9A)
42060	A44C			*S* Execution of "CSAVE" BASIC command (Token $98)
42136	A498			*S* Execution of "CLOAD" BASIC command (Token $97)
42302	A53E			*S* Execution of "EXEC" BASIC command (Token $A2)
42340	A564			*S* Execution of "INKEY$" BASIC function (Token $FF92)
42394	A59A			*S* Transfer block
42446	A5CE			*S* Execution of "EOF" Basic function (Token $FF8C)
42476	A5EC			*S* Execution of "SKIPF" command (Token $A3)
42486	A5F6			*S* Execution of "OPEN" command (Token $99)

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
40960	A000	49151	BFFF	BASIC ROM[1] Cont.
42537	A629			*S* Open a tape file for input
42625	A681			*S* Find a file specified by filename $1D2 - $1D9
42750	A6FE			*S* Blink Corner of the screen
42753	A701			*S* Read one record from tape with motor control (sync, read gap, read block)
42763	A70B			*S* Plain read block from cassette only; motor must be on and in bit sync; $7C holds block type, $7D holds blocksize; U and Y are preserved; if no errors Z is 1, A is 0, X = buffer start + block length; if checksum error Z is 0, A is 1, X points beyond bad address; if memory error Z is 0 and A is 2.
42825	A749			*S* Read one byte
42837	A755			*S* Read one bit
42876	A77C			*S* Turn on tape motor synchronize data (read gap/$55's); U and Y are preserved; FIRQ and IRQ are masked
42941	A7BD			*S* Execution of "MOTOR" command (Token $9F)
42954	A7CA			*S* Turn on tape motor
42961	A7D1			*S* 500 millisecond delay
42968	A7D8			*S* Turn on tape motor and write leader/gap/$55's
42981	A7E5			*S* Write one record to tape with motor control
42985	A7E9			*S* Turn off tape motor
42996	A7F4			*S* Write Block; tape should be up to speed and leader of $55's already written in 1st block; $7E contains the buffer address; $7C contains the block type; $7D contains number of data bytes in block; X= buffer address + number of data bytes; all registers modified
43050	A82A			*S* Write one byte
43100	A85C			Sine table
43136	A880			*S* Execution of "SET" command (Token $9C)
43185	A8B1			*S* Execution of "RESET" command (Token $9D)
43253	A8F5			*S* Execution of "POINT" Basic function (Token $FF91)

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
40960	A000	49151	BFFF	BASIC ROM[1] Cont.
43280	A910			*S* Execution of "CLS" command (Token $9E)
43304	A928			*S* Clear screen to blanks and home cursor
43339	A94B			*S* Execution of "SOUND" command (Token $A0)
43350	A956			*S* Generate a sound determined by pitch and sound
43408	A990			*S* Execution of "AUDIO" command (Token $A1)
43426	A9A2			*S* Select joystick routine
43462	A9C6			*S* Execution of "JOYSTK" Basic function (Token $FF8D)
43486	A9DE			*S* Read positions of joysticks
43546	AA1A	43560	AA28	*S* ROM part of get next character routine called from $00A8. Ref. [5] #12.
43561	AA29	43600	AA50	Table of Pointers to subroutine entry addresses associated with Basic Function Keyword Table defined at $AB1A to AB66. Ref. [7] Dec 1982 Anniversary Issue.

Contents	For Function
$BC7A	SGN
$BCEE	INT
$BC93	ABS
$0112	USR
$BF1F	RND
$BF78	SIN
$B750	PEEK
$B681	LEN
$B4FD	STR$
$B716	VAL
$B6A0	ASC
$B68C	CHR$
$A5CE	EOF
$A9C6	JOYSTK
$B6AB	LEFT$
$B6C8	RIGHT$
$B6CF	MID$
$A8F5	POINT
$A564	INKEY$
$B4EE	MEM

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
43622	AA66	43801	AB19	BASIC Command keyword - token table - ASCII Characters Ref. [7] December 1982 Anniversary Issue

CONTAINS STRING	CONVERTED TO TOKEN
FOR	$80
GO	$81
REM	$82
'	$83

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
40960	A000	49151	BFFF	BASIC ROM[1] Cont.

43631	AA6F	43634	AA72	ELSE $84
43635	AA73	43636	AA74	IF $85
43637	AA75	43640	AA78	DATA $86
43641	AA79	43645	AA7D	PRINT $87
43646	AA7E	43647	AA7F	ON $88
43648	AA80	43652	AA84	INPUT $89
43653	AA85	43655	AA87	END $8A
43656	AA88	43659	AA8B	NEXT $8B
43660	AA8C	43662	AA8E	DIM $8C
43663	AA8F	43666	AA92	READ $8D
43667	AA93	43669	AA95	RUN $8E
43670	AA96	43676	AA9C	RESTORE $8F
43677	AA9D	43682	AAA2	RETURN $90
43683	AAA3	43686	AAA6	STOP $91
43687	AAA7	43690	AAAA	POKE $92
43691	AAAB	43694	AAAE	CONT $93
43695	AAAF	43698	AAB2	LIST $94
43699	AAB3	43703	AAB7	CLEAR $95
43704	AAB8	43706	AABA	NEW $96
43707	AABB	43711	AABF	CLOAD $97
43712	AAC0	43716	AAC4	CSAVE $98
43717	AAC5	43720	AAC8	OPEN $99
43721	AAC9	43725	AACD	CLOSE $9A
43726	AACE	43730	AAD2	LLIST $9B
43731	AAD3	43733	AAD5	SET $9C
43734	AAD6	43738	AADA	RESET $9D
43739	AADB	43741	AADD	CLS $9E
43742	AADE	43746	AAE2	MOTOR $9F
43747	AAE3	43751	AAE7	SOUND $A0
43752	AAE8	43756	AAEC	AUDIO $A1
43757	AAED	43760	AAF0	EXEC $A2
43761	AAF1	43765	AAF5	SKIPF $A3
43766	AAF6	43769	AAF9	TAB($A4
43770	AAFA	43771	AAFB	TO $A5
43772	AAFC	43774	AAFE	SUB $A6
43775	AAFF	43778	AB02	THEN $A7
43779	AB03	43781	AB05	NOT $A8

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
43622	AA66	43801	AB19	BASIC Command keyword - token table - ASCII Characters Ref. [7] December 1982 Anniversary Issue

CONTAINS STRING	CONVERTED TO TOKEN
STEP	$A9
OFF	$AA
+	$AB
-	$AC
*	$AD
/	$AE
^	$AF
AND	$B0
OR	$B1
>	$B2
=	$B3
<	$B4

```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                    Description
----- ---- ----- ----  ------------------------------------------

40960 A000 49151 BFFF   BASIC ROM[1] Cont.

  43802 AB1A 43878 AB65   BASIC Function keyword - token table - ASCII
                          Characters Ref. [7] December 1982 Anniversary Issue

                            CONTAINS   CONVERTED TO
                            STRING     TOKEN
      43802 AB1A 43804 AB1C   SGN        $FF80
      43805 AB1D 43807 AB1F   INT        $FF81
      43808 AB20 43810 AB22   ABS        $FF82
      43811 AB23 43813 AB25   USR        $FF83
      43814 AB26 43816 AB28   RND        $FF84
      43817 AB29 43819 AB2B   SIN        $FF85
      43820 AB2C 43823 AB2F   PEEK       $FF86
      43824 AB30 43826 AB32   LEN        $FF87
      43827 AB33 43830 AB36   STR$       $FF88
      43831 AB37 43833 AB39   VAL        $FF89
      43834 AB3A 43836 AB3C   ASC        $FF8A
      43837 AB3D 43840 AB40   CHR$       $FF8B
      43841 AB41 43843 AB43   EOF        $FF8C
      43844 AB44 43849 AB49   JOYSTK     $FF8D
      43850 AB4A 43854 AB4E   LEFT$      $FF8E
      43855 AB4F 43860 AB54   RIGHT$     $FF8F
      43861 AB55 43864 AB58   MID$       $FF90
      43865 AB59 43869 AB5D   POINT      $FF91
      43870 AB5E 43875 AB63   INKEY$     $FF92
      43876 AB64 43878 AB65   MEM        $FF93

  43879 AB67 43950 ABAE   Table of Pointers to subroutine entry addresses
                          associated with BASIC Command Keyword Table defined
                          at $AA66 to $AB19 Ref. [7] December 1982
                          Anniversary Issue.

                            Contents   For Command
      43879 AB67            $AD47      FOR
      43881 AB69            $AE86      GO
      43883 AB6B            $AEE3      REM
      43885 AB6D            $AEE3      '
      43887 AB6F            $AEE3      ELSE
      43889 AB71            $AF14      IF
      43891 AB73            $AEE0      DATA
      43893 AB75            $B8F7      PRINT
      43895 AB77            $AF42      ON
      43897 AB79            $AFF5      INPUT
      43899 AB7B            $AE02      END
      43901 AB7D            $B0F8      NEXT
      43903 AB7F            $B34E      DIM
      43905 AB81            $B046      READ
      43907 AB83            $AE75      RUN
      43909 AB85            $ADE4      RESTORE
      43911 AB87            $AEC0      RETURN
      43913 AB89            $AE09      STOP
      43915 AB8B            $B757      POKE
      43917 AB8D            $AE30      CONT
      43919 AB8F            $B764      LIST
      43921 AB91            $AE41      CLEAR
      43923 AB93            $AD17      NEW
```

```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                    Description
----- ---- ----- ----  ------------------------------------------

40960 A000 49151 BFFF   BASIC ROM[1] Cont.

      43925 AB95            $A498      CLOAD
      43927 AB97            $A44C      CSAVE
      43929 AB99            $A5F6      OPEN
      43931 AB9B            $A416      CLOSE
      43933 AB9D            $B75E      LLIST
      43935 AB9F            $A880      SET
      43937 ABA1            $A881      RESET
      43939 ABA3            $A910      CLS
      43941 ABA5            $A78D      MOTOR
      43943 ABA7            $A94B      SOUND
      43945 ABA9            $A990      AUDIO
      43947 ABAB            $A53E      EXEC
      43949 ABAD            $A5EC      SKIPF

  44064 AC20                *S* Routine to move a block of memory; $41-$42
                            holds destination top address; $43-$44 holds
                            source top address; $45-$46 holds destination
                            bottom address; $47-$48 holds source bottom
                            address.

  44102 AC46                *S* Not enough room error message routine

  44147 AC73 44189 AC9D     *S* Entry to command level of BASIC. This is the
                            idle loop. Print "OK", close files, tokenize
                            line, then JMP $ADC0. Ref. [5] #12

  44313 AD17                *S* Execution of "NEW" BASIC command (Token $96)

  44359 AD47                *S* Execution of "FOR" BASIC command (Token $80)

  44446 AD9E 44484 ADC4     *S* Interpret loop Ref. [5] #12

  44486 ADC6 44542 ADFE     *S* Execute line Ref. [5] #12

  44516 ADE4                *S* Execution of "RESTORE" BASIC command
                            (Token $8F)

  44546 AE02                *S* Execution of "END" BASIC command (Token $8A)

  44553 AE09                *S* Execution of "STOP" BASIC command (Token $91)

  44592 AE30                *S* Exection of "CONT" BASIC command (Token $93)

  44609 AE41                *S* Execution of "CLEAR" BASIC command (Token $95)

  44661 AE75                *S* Execution of "RUN" BASIC command (Token $8E)

  44678 AE86                *S* Execution of "GO" BASIC command (Token $81)

  44736 AEC0                *S* Execution of "RETURN" BASIC command (Token $90)

  44768 AEE0                *S* Execution of "DATA" BASIC command (Token $86)

  44771 AEE3                *S* Execution of "REM or '" BASIC command
                            (Token $83)
                            *S* Execution of "ELSE" BASIC command (Token $84)
```

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
40960	A000	49151	BFFF	BASIC ROM[1] Cont.
44820	AF14			*S* Execution of "IF" BASIC command (Token $85)
44866	AF42			*S* Execution of "ON" BASIC command (Token $88)
44937	AF89			*S* Execution of "LET" Extended BASIC command (Token $BA)
45045	AFF5			*S* Execution of "INPUT" BASIC command (Token $89)
45126	B046			*S* Execution of "READ" BASIC command (Token $8D)
45304	B0F8			*S* Execution of "NEXT" BASIC command (Token $8B)
45607	B227			*S* Get operand
45902	B34E			*S* Execution of "DIM" BASIC command (Token $8C)
46061	B3ED			*S* INTCNV[2] convert floating point number to a 16 bit 2's compliment integer; if number exceeds + or - 32768 an overflow error will occur and a return to Basic.
46324	B4F4			*S* Returns an integer to BASIC from D loaded with 2's compliment
46333	B4FD			*S* Execution of "STR$" BASIC function (Token $FF88)
46445	B55D	46605	B60C	Garbage collection routines Ref. [5] #10
46445	B56D			Allocate String in string buffer
46481	B591			Garbage Collection
46552	B5D8			Process a descriptor
46575	B5EF			Compact a string
46721	B681			*S* Execution of "LEN" BASIC function (Token $FF87)
46732	B68C			*S* Execution of "CHR$" BASIC function (Token $FF8B)
46763	B6AB			*S* Execution of "LEFT$" BASIC function (Token $FF8E)
46764	B6AC			*S* Execution of "ASC" BASIC function (Token $FF8A)
46792	B6C8			*S* Execution of "RIGHT$" BASIC function (Token $FF8F)
46799	B6CF			*S* Execution of "MID$" BASIC function (Token $FF90)
46870	B716			*S* Execution of "VAL" BASIC function (Token $FF89)
46928	B750			*S* Execution of "PEEK" BASIC function (Token $FF86)

Beginning DEC ADDR	Beginning HEX ADDR	Ending DEC ADDR	Ending HEX ADDR	Description
40960	A000	49151	BFFF	BASIC ROM[1] Cont.
46935	B757			*S* Execution of "POKE" BASIC command (Token $92)
46942	B75E			*S* Execution of "LLIST" BASIC command (Token $9B)
46948	B764			*S* Execution of "LIST" BASIC command (Token $94)
47042	B7C2	47349	B8F5	Tokenize & Untokenize Routines Ref. [5] #7
47042	B7C2	47136	B820	*S* Untokenize Routine
47042	B7C2			RAM Hook from untokenize routine
47078	B7E6			Untokenize one token
47137	B821	47349	B8F5	*S* Tokenize Routine
47137	B821			RAM Hook from tokenize routine
47250	B892			Tokenize one word
47351	B8F7			*S* Execution of "PRINT" BASIC command (Token $87)
47532	B9AC			*S* Print a space
47545	B9B9			*S* Floating point subtract FPAC1=[X]-FPAC1
47554	B9C2			*S* Floating point add FPAC1=[X]+FPAC1
47818	BACA			*S* Floating point multiply FPAC1=[X]*FPAC1
48015	BB8F			*S* Floating point divide FPAC1=[X]/FPAC1
48250	BC7A			*S* Execution of "SGN" Basic function (Token $FF80)
48275	BC93			*S* Execution of "ABS" Basic function (Token $FF82)
48366	BCEE			*S* Execution of "INT" Basic function (Token $FF81)
48588	BDCC			*S* Display decimal value in D
48927	BF1F			*S* Execution of "RND" Basic function (Token $FF84)
49016	BF78			*S* Execution of "SIN" Basic function (Token $FF95)
49138	BFF2	49151	BFFF	Interrupt and reset vectors
49138	BFF2	49139	BFF3	SWI3 Vector
49140	BFF4	49141	BFF5	SWI2 Vector
49142	BFF6	49143	BFF7	FIRQ Vector
49144	BFF8	49145	BFF9	IRQ Vector
49146	BFFA	49147	BFFB	SWI1 Vector
49148	BFFC	49149	BFFD	NMI Vector
49150	BFFE	49151	BFFF	RESET Vector

Elite Calc:* Impressive Spreadsheet For Home, Business

By Stuart Hawkinson

Elite Calc* is a great spreadsheet program! This professional quality program has the performance required for serious home applications as well as small businesses. The number of features in this offering from Elite Software is impressive. It has all the functions you need to perform sophisticated "what if" business projections and prepare tabular reports, to maintain home records and to balance your checkbook.

Electronic spreadsheet programs offer such a natural application of personal computers that most owners of micros should become familiar with their use. You can set up a data worksheet with pre-programmed relationships between columns or rows, and interact with your calculations to explore alternative strategies. Since the calculations follow directly from entering or changing the data, you are spared the drudgery of manual arithmetic. In addition, once the relationships are defined, no computational errors are made.

As in most spreadsheet programs, *Elite* Calc* allows you to directly address columns and rows in your table. The columns are designated by letters and the rows by numbers, the same convention used by the popular electronic spreadsheets like *VisiCalc* and *SuperCalc*. The program allows up to 255 columns and rows. The actual number that can be effectively used depends on the size of your computer's memory and the amount of room used by each entry.

Elite Calc* maximizes the amount of usable space available to you. The program is written in machine language and makes extensive calls to Color Computer Extended BASIC (and Disk BASIC if you are using the disk version). This also means that you have some very powerful numerical functions and editing features at your command.

Elite Calc* is designed to provide most of the features found in the "higher priced spreads." Furthermore, it has a number of unique features that are unavailable in programs like *VisiCalc*, or found only in the expensive "advanced" versions. The program's built in *help* facility gives you two pages of command summaries. This frees you from reading the manual soon after learning the basics of operation. In addition to automatically advancing to the next cell in the sheet after each entry, the program also provides extensive editing capabilities. This is unique to *Elite* Calc*. The familiar Extended BASIC line editor is used to edit formulas and titles, making the system quick and easy to master. You use the same editing commands as in BASIC!

The full range of functions available in Extended BASIC are provided for establishing relationships among the data. You can use the common arithmetic operations of +, -, * and / as well as exponentiation and square root. The trigonometric functions and logarithms are also available. A very welcome feature of *Elite* Calc* is the incorporation of the *IF—THEN—ELSE* statement of BASIC, along with the full range of conditional expressions. This is necessary for doing

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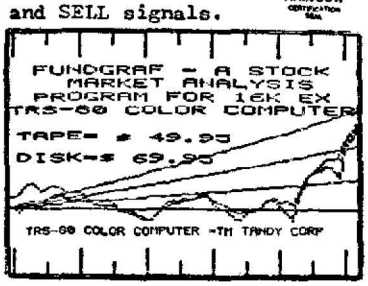
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many types of projections and decision making calculations, expanding the types of problems you can solve. Most simplified spreadsheets lack this capability.

Besides the normal arithmetic functions, *Elite* Calc* also provides some functions which are unique to spreadsheet programs. These include COUNT, SUM and AVERAGE for doing table calculations. You can also find MIN and MAX values or LOOKUP a value from any column or row. The only missing functions are those supplied with more expensive spreadsheets, specialized financial calculations like NPV (net present value) and IRR (internal rate of return). Also, you cannot code a value as NA (not available) in *Elite* Calc*, useful if your data are incomplete.

Elite Calc* allows you to enter an expression in place of a value. This means that you can practically dispose of your pocket calculator. If you need to enter the monthly principal on a three year, ten thousand dollar loan, just enter +10000/36. *Elite* Calc* will supply the correct result. Another unique feature of *Elite* Calc* provides a separate page of user-defined constants. You can keep *pi* or other necessary constants in a separate table, freeing up space in the spreadsheet for entries which are specific to your application.

The most remarkable feature of *Elite* Calc* is its sort function. Sort by either row or column, and the related rows or columns are rearranged accordingly. This feature is an expensive ($100-$250) add-on to many of the more popular spreadsheets. The sort will also work with text entries, allowing you to alphabetize a report, or other text items. This feature, in conjunction with *Elite* Calc's* extensive formatting functions, easily prints reports which would normally require a sophisticated data base program.

Elite Calc* in the disk version is also well integrated into the CoCo's disk operating system. You can call for a directory listing before loading or writing a file. This feature is useful to recall the filename you need. Another friendly feature of *Elite* Calc* is the ability to switch from numeric to text mode for entering labels and headings. Calculations can be suspended while entering data to speed up the operations significantly. If more programs included these features, our frustrations with computers would soon disappear.

The program I reviewed is supplied on disk and is easily backed up for the user's protection. To run the program simply type *RUN*"CALC." The program automatically adjusts itself to your CoCo's memory size. The manual supplied with the program describes all of its functions in detail. (All functions except the conditional expressions, that is. What could be more important than *IF* statements for doing "what if" calculations? I only found out about them through reading the accompanying advertising. Their description was missing from the manual.) Included with the disk and manual are three applications with which to practice: a check ledger, a loan amortization schedule, and a sales report. The manual does not do much to teach you about spreadsheets in general. I recommend that you either obtain one of the many good books on *VisiCalc* or *SuperCalc*, or work with a friend's spreadsheet program to explore tutorial material. It will then be easy to adapt to *Elite* Calc's* slightly different command structure.

My overall impression of *Elite* Calc* is very favorable: easily one of the best spreadsheets available for the Color Computer. It provides all the features that are required to do really serious work. *Elite* Calc* is a well designed piece of personal software. At $44.95 it's a steal.

(Elite Software, P.O. Box 11224, Pittsburgh, PA 15238, (412) 795-8492, 16K, 32K or 64K Color Computer disk or tape, $44.95)

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Due to heavy demand, we suggest you order back issues you want now while supplies last.

In addition, copies of the cover *only* of the July, 1982, Anniversary Issue are available separately for $1 each, plus 50 cents shipping and handling. These are suitable for framing.

Nerble Force Called Fun For Active Youngsters

To really enjoy *Nerble Force,* you need to psych yourself into imagining that you're one of the last human survivors on the planet Nerble (I think it's one of those tiny stars in the Milky Way, but I wouldn't bet on it). All of your comrades are on the surface of the planet, while you are in the only remaining friendly spaceship. Your goal is to defend the humans on the planet against the *Nerble Force* (they've probably learned what happened to the American Indians) who are out to get you and your friends.

The game is quite similar to one called Planet Raiders by Aardvark, except that a distinguishing feature, the bottom third of the screen, is a long-range scanner that allows you to detect the enemy beyond the screen perimeters. My seven-year-old son and I found the device to be quite intriguing useful in our continuing episodes against the Nerbloids.

There actually are six types of Nerbloids, with various kinds of responses that keep you confused and panicky the first few runs through the game. The Grabbers attempt to kidnap your friends. If a Grabber is successful in getting to the top of the screen with his catch, the Grabber mutates into a Wiggler. Both Grabbers and Wigglers are worth 150 points. If you shoot a Grabber while he is carrying a man, you get 500 points—and another 500 if you catch your friend and return him to the ground safely.

Then there are the Miners, who move up and down leaving explosive mines, and are worth 500 additional points. The Groupers, worth 150 points, try to ram your ship from the side when it is nearby. The Groupers are formed from Space Eggs (worth 1,000 points) when shot.

The Chasers are the ones who will eventually get you because they follow your ship at all times. They're the hardest to knock down and you only receive 200 points when you are successful.

There are eight waves per level, which end when you have knocked out eight Grabbers or Wigglers. You are awarded 100 points for each surviving man after each wave.

If you get too excited during the course of the game, you can press the letter "T" to freeze the action (it works, too, if you merely need to answer the phone). Pressing "U" allows you to resume play.

I found the graphics to be the redeeming feature of the game, and the use of the long-range scanning device was fascinating (you could, and we did, manage to play using only the radar). It's a game for active youngsters really, and they will play for hours—long after you have tired of it and are anxious to try out some of your utilities.

(Computerware, P.O. Box 668, Encinitas, CA 92024, $24.95 tape, $29.95 disk)

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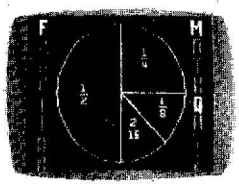
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After a month of paging around CompuServe and after receiving my first month's bill and Ma Bell's charges (I live in the boonies and have to access the local number via long distance) my time on line was severely curtailed. Just when I was questioning the utility of a modem for my applications, along came *UPLOAD*.

UPLOAD is a program, actually a series of three programs, which provide the Extended Color Computer the ability to transfer programs to another 80C.

Initially I was confused about the operation of *UPLOAD*, but I had the opportunity to meet the author, James Hornsby, at *Rainbow*fest and he walked me through the program. Drifting away from the review, it seems that all the principles of Color Computerdom were at *Rainbow*fest. The trek from California was well worth it. The points which caused my confusion will be clarified in a revised instruction manual.

UPLOAD does not require a terminal program to operate. Your CoCo and a modem (300 or 1200 bps) can transfer BASIC or machine language programs to another without editing. The programs arrive at the receiving end ready to run. *UPLOAD* is actually a group of three programs: *UPLOAD; DLOAD-MPC;* and *UPLOAD-D*.

Here's how they work. For a program written in BASIC, the sender loads *UPLOAD* and *EXECutes* the program. *UPLOAD* then asks the sender to type in the name of the programs to be transferred. After entering this name and positioning the tape with the program, *UPLOAD* will search the tape until it finds the desired program. The program is then loaded into the computer ready to be transmitted.

The receiver then types *DLOAD* "Program name," and a 0 if a 300 Baud modem is being used. The program transfer will start and continue to completion. Completion is signaled by an "OK" and control is returned to BASIC at both ends. The receiver can then *SAVE, LIST, PRINT* or *RUN* the program.

During transfer *UPLOAD* sends and monitors the transmission. It sends data in blocks of 128 characters and checks for errors. If an error occurs that block will be resent. Transmission will abort after a block fails self-check five times, a situation I have not encountered.

To send a machine language program, the receiver must first load the second program, *DLOAD-MPC*, into his 80C. If the receiver does not have the program, no problem—it's a BASIC program and can be sent using the previous method, and then have the receiving computer *LOAD* and *RUN* it.

The transfer is almost identical to transferring a BASIC program, except for adding *M* to the *DLOAD* code. During transfer, the three pertinent locations of the machine language program are displayed on the sending screen. This info enables the receiver to *CSAVEM* the program after it is received.

BASIC programs can also be sent using *DLOAD-MPC* at the receiving end. The BASIC program is then "tokenized" and transmission time is cut about 20 percent. Using this method, the BASIC program is actually sent as a machine language program.

The third program, *UPLOAD-D*, is the disk version of *UPLOAD*. *UPLOAD* only transfers programs saved on tape, whereas *UPLOAD-D* only transfers programs saved on disk. All three programs are supplied on cassette tape.

Jim stated that *UPLOAD* is "not designed as a method to transfer protected programs." It may or may not transfer programs which have an auto run machine language loader added. Transfer time when using a 300 Baud modem is at least five times the loading time of a cassette.

The program is user friendly and self-prompting. Errors are self-correcting and unintentional input errors do not result in a program dump.

ML 'USR Software has placed the BASIC language receiving program *DLOAD-MPC* in the public domain for use by anyone. The sending programs *UPLOAD* and *UPLOAD-D* are copyrighted and transferring it to another is illegal.

The programs are so good and easy to use, they may become a "standard" in inter-Color Computer transfer. If you have a 16K minimum 80C, a modem and know someone who has the same, get this program.

(ML 'USR Software, 115 Rising Sun, Ft. Mitchell, KY 41017, $16.95)

—Bruce C. Rothermel

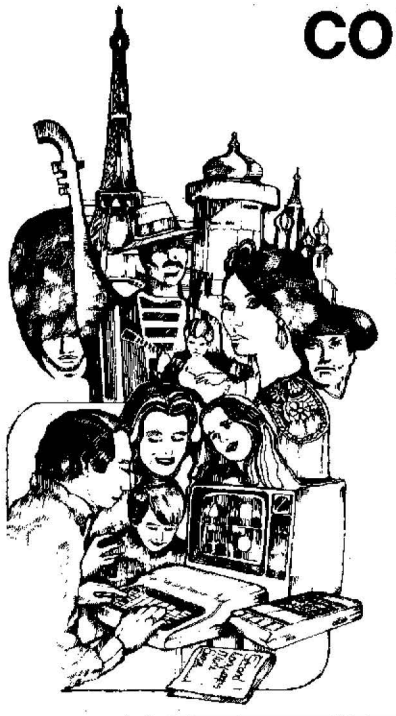
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Blackjack Royale Beats Them At Their Own Game

By Thomas C. Roginski, Ph.D.

I really jumped at the chance to review this program! In addition to being an environmental chemist, I am the co-author of a major book on Blackjack, *Playing Blackjack in Atlatic City* and have given lectures on gambling on local television and at civic groups. *Blackjack Royale* (which I will call *BR* to save space below) is just the type of program that the Color Computer needs. While other programs for the CoCo may *play* Blackjack, this is the only program which provides a training aid for the proper way to *win* at the game.

First, I think it might be of value to explain certain features of the game of Blackjack which make it different from other casino games. All of us who have been to the large casinos at Las Vegas and Atlantic City can marvel at gaudy buildings such as the Roman Empire had never seen. These buildings were not built by winners but by losers. They are there to separate you from your money. Inside you lose all sense of time and value. Even the rest rooms are hard to find for all the flashing machines.

The only game which gives the player an even (and actually the expert player a better than even) play is Blackjack. While I was in graduate school in the mid '60s, a math professor named Thorp published the first book on how to beat the game. "Card counting" was born. Card counting is a method of keeping track of the types of cards which have been played and tells the player how to bet and play each hand to obtain the maximum yield on each hand. Since the time of Thorp many advances have been made to aid the casino and the player. Thorp's original method would not win in a modern casino.

During the 20 years since it has been known that the game could be beat, the number of total gambling spots in Nevada has doubled but the number of Blackjack spots has increased by a factor of 10. Remember that these were not built by winners but by losers! The paradox is resolved when you realize that people read that the game CAN be beat so they think that THEY can beat it. All major casino Blackjack can be beaten today. When people ask me how to do it they want a sure fire and quick (especially quick) way of doing it. When they hear that they must spend 10 to 20 hours to get even with the house and 100+ hours to get 1½ percent advantage, many lose interest. If there were an easy and quick method of beating the house all of the time and I knew about it, I wouldn't tell you and neither would anyone else.

This brings us back to the program *Blackjack Royale*. This game is designed for 32K Extended BASIC and no joysticks. If I want to compare this tape with others I must go to programs for other computers because no other such program exists for the CoCo. Jerry Patterson has an excellent program for the Model III which costs somewhat more and is limited by less graphics available on that machine. Jerry's program provides the ability for several players to play at the same time while *BR* does not. Otherwise, the two programs are about equal (at least in the variation that I saw). Stanford Wong has a program for the IBM PC which I have not seen, but which does cost about $225 more than the price for the CoCo program reviewed here.

The graphics for *BR* are excellent. My wife and kids were thrilled by the neat high-res cards and the funny faces on the face cards. Because of the need to save space even in a 32K machine, *BR* uses diamonds as the only card suit. This is okay because the suits mean nothing in Blackjack. It is important to show cards that look like cards to get the experience with rapid card recognition. *BR* does that well. The diamonds are shown as black suits in PMODE4 by this program. It might have been better to use clubs or spades or use the "false color" red in PMODE4.

The nicest feature of *BR* is the possibility of setting rules for most of the major casinos and any counting system you wish to try. I tried several: simple, intermediate, and advanced systems. This program keeps a perfect count (except as noted below in the bugs). My system, like the system by Wong, uses halves of points for certain cards (2 and 7 = ½). *BR* kept up with it. The count is not shown to you unless you call for it on the text screen. The text screen also shows the numbers of each card that has been dealt. This is a count which not even the best of counters can do! It is good that the count is not shown on the main screen because you must learn to count without this help at the tables. Use this feature less and less as you get experience. This program is better practice than endless dealing of cards because of this check feature. After you get enough experience to win, you will find the deal a little slow. The real game is faster, especially in Atlantic City.

The documentation of *BR* is acceptable in format (printer VII printout I believe). The content is excellent, however, and explains all of the nice features clearly. I disagree with

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ARIZIN
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the author on a few technical points but nothing major. For the multi-deck games, the computer will shuffle much too soon. I think that is what line 205 does. The default game given in the program is listed as a typical casino game in the write up. This game is very uncommon today. The one thing that is lacking is a "Basic Strategy." A Basic Strategy is that method of play of the cards and is modified by the count. You cannot play correct Blackjack without this. The author of *BR* lists four books to try for this, but Thorp's book is obsolete. To this list I would add Wong's "Professional Blackjack." Modesty forbids me from mentioning "Playing Blackjack in Atlantic City" by Chambliss and Roginski. The author of *BR* could not publish a basic strategy, because these are copyrighted. If there is enough interest, *Rainbow* might be talked into publishing one which I could donate.

This software has an amusing protection method. This was a little annoying until solved because of the bugs which are still present.

Well, nothing is perfect. A few bugs still are present in this otherwise superb program. Most of these are minor; one is serious. My description of these is rather technical if you do not know the rules of casino Blackjack. Read one of the books mentioned for the rules. The surrender option used at a few casinos is not played correctly by this program. A new dealer's hand should be dealt as well as a new players hand. When you try to resplit pairs (an option in Nevada but not in Atlantic City) the program cheats so don't do it. To input your bet the computer uses the VAL expression of the INKEY$. If you type a letter instead of a number, the program takes it as a zero and may goof on your bet. If you try to double after splitting pairs (a common rule in Atlantic City), the program will sometimes goof and take one of your bets.

There is one major flaw that must (and I am sure will) be changed. When you run through several hands and the program shuffles, the variable DPV (deck point value) is not reset in some paths through the program. This means that the point count given on the text screen is absolutely wrong. One way to reset this is to bet all of your money on the new hand, lose, and then reinput the parameters for a new game. This is very time wasting. Do not let this problem stop you from the purchase of this fine program. I am sure that the author will make a change in future versions of the program.

If you want to have fun and make money at the house's expense, play Blackjack when you go to a casino. This fine program and a good Blackjack book are a *must* for the CoCo Blackjack player.

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Electronic Calligrapher: Simple Yet Elegant

One of the more interesting but yet vastly under-used capabilities of most printers is in the use of dot graphics. Using this mode of printing, it should theoretically be possible to print anything desired. So far, the only use of this mode that I have seen is in some graphic screen print programs. This might be due to the fact that the printer manuals that I have seen discuss the printing of dot graphics in a manner that is confusing at best. Wouldn't it be nice if someone came up with another use for dot graphic printing?

Electronic Calligrapher is a disk-based utility program that will turn your otherwise dull printer into a fancy, old fashioned scribe. It is written in BASIC and is designed for use with the Radio Shack Line Printers VII and VIII, or equivalent. With it, you can print fancy lettering in either the *Old English* or *Chancery Cursive* fonts. The letters printed are approximately three to four times larger than those printed in the normal mode of operation, and you can print up to 26 characters (including spaces) per line. The text printed is automatically centered on the line unless you tell the program not to center it. Although special characters are not supported, the entire alphabet, including both upper and lower case as well as numerals can be printed.

Using *Electronic Calligrapher* is about as easy and straightforward as you can get. The first thing that you have to do after you *RUN* the program is to enter the text that you want to be printed. The next thing you do is decide which of the two fonts you want your text to be printed in. Pretty easy so far, right? Once you have finished with these rigorous (?) preliminaries, about all you have to do is to make sure that your printer is turned on and that it has some paper in it. This is my kind of program (it does all the work).

Electronic Calligrapher is about to do its thing. Your disk drive starts up, and begins to spin, whirr, and click like mad, as the program reads the necessary data from disk, in order to properly format the letters. Printing is accomplished in three to five passes, depending on the letters being printed. After the first pass, the only thing that you can see is the very tops of the letters. As each pass is completed, more and more of the letters become evident as they begin to take form. When the printing is completed, you can either start all over again, or end the program.

Electronic Calligrapher is a nifty utility program whose time has come. The quality and detail of the printing is excellent, and the program performs impeccably. The documentation, which is skimpy at best, nonetheless explains everything you need to know, and in fact, is hardly necessary. If you would like to jazz up your printing, you should buy this program. Would anyone care to try to come up with a version in true script?

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—Gerry Schechter

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Challenging *Firecopter* Has Realistic Sound Effects

One of the vivid memories of my childhood is of riding aboard the small town's bright red firetruck with the 30 other youngsters in Mrs. Clough's second grade class. We were the heroes of the moment, eagerly returning the smiles and waves of those along the sidewalks who appreciated our excitement. It was easy to imagine that we were on our way to a raging fire and that a desperate family was counting on us.

Never in my wildest dreams would I have thought that someday through the magic of the computer, I would step aboard a *Firecopter* and be responsible for the safety of a major city. That's exactly what is expected of you in this new creation by Adventure International of Longwood, Fla.

The object of *Firecopter* is to keep your community from being burned to the ground by the "minions of Pyro Maniac—the mindless but persistent fire-droids." To accomplish this seemingly impossible task, you are not only expected to put out the fires before they start, but destroy the fire-droids, too. There also are sniper-droids who will try to shoot you out of the sky, and they, too, must be stopped.

Knowing what's expected of you (thanks to four pages of documentation), you confidently *CLOADM* this 16K challenge. When you get your OK prompt, type in *EXEC* 8192 and take off. If you're playing solo, move the right joystick to the left. If you have an opponent, move it to the right.

Suddenly, you're airborne and the city skyline stretches out before you in all of its wonder, diverse shapes and various stages of development.

Out of the corner of your eye, you spot a suspicious-looking character lurking behind a corner. You circle around to take a closer look, and your suspicions are confirmed that this is indeed one of the fire-droids you have been briefed on—because in his right hand he is holding a torch. There's no time to capture him because any hesitation will result in the possible death of innocent office workers.

Now's the moment you were being prepared for back in basic training: You have only seconds to line the fire-droid up in your sights, squeeze the fire button and eliminate the demon with your laser. You fire . . . and miss. Circling around for another look, you spot a small two story building on fire. You figure you still have time to eliminate the droid. You get him the second time (along with 500 points) and then maneuver into position to try to drown the fire. You hold the fire button down, a stream of water douses the fire (small fire worth 40 points) and you resume your patrol.

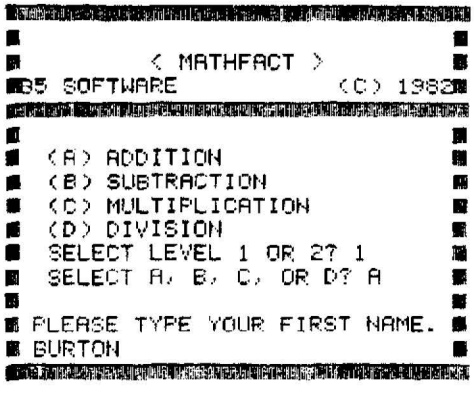
The next thing you know, you're being fired upon by a sniper-droid. Eliminating him gives you 300 points, but usually, by the time you've spotted a droid, buildings are burning. And you have to decide between getting the droid or putting out the fire. Large fires may be worth as much as 1,000 points or more.

After a while, however, it seems the droids have multiplied exponentially, while the buildings are everywhere ablaze. The monitor indicates that the fires have reached a critical stage, meaning that you have only seconds before they are completely out of control and the city will be burned to the ground. You do what you can while you have time.

Firecopter is a well conceived game, accompanied by very realistic sound effects. A siren at the start sets the mood, and the constant whirling noise sounds just like a helicopter, constantly boosting your fantasy trip. The city's landscape is nicely drawn, but I think the game would be nicer if some of the buildings had been made different colors (maybe too much to ask of a 16K game) to show off CoCo's potential. I found that it takes a few flights through the game to become proficient at firing the lasers and the water jets, but that made it even more challenging. Eventually you do become the hero you knew you were in second grade. Thanks, Mrs. Clough!

(Adventure International, Box 3435, Longwood, FL 32750, $24.95 on tape)

—Charles Springer



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Disk Money Minder: A Home Budget Ledger

Disk Money Minder is a home budget program that allows you to keep a family budget ledger. It can also be used for a variety of financial record keeping chores. You need a 32K Color Computer with Radio Shack's disk system. The program represents a substantial enhancement of Harmonycs' cassette-based program *Money Minder II.*

The program is designed to divide your checkbook balance into as many as 56 different categories. This allows you to track expenses in each category, while keeping current balances. The program will display or print the balances in each category. Once you have established a model system, you can enter checks, with their numbers, and charge them against the various budget categories.

A whole session with *Disk Money Minder* can be recorded to disk. Errors in entries (ie, the amount of a check) can be corrected by re-entering the amounts charged to each category. The names of categories can be edited during any session. However, the labels of the entries (ie, the check numbers) cannot be edited. Consequently, you can wind up with entries without any associated dollar amounts.

The program will search through the disk files to find a particular series of check entries. (The program also searches through tape files created by *Money Minder II,* so you won't have to re-enter your data if you are upgrading from tape to disk.) It then sums the checks' contributions to each category and prints a summary. Thus, you can make permanent records of your budgeting progress. However, an option to print a list of checks found is not available.

The program is distributed on an unprotected disk, and you are encouraged to make backup copies. I like that aspect, and think we should all respect the manufacturer's willingness to provide unprotected, copyrighted software. The program comes with a 20-page manual which includes a complete program listing. The first three chapters describe the program's capabilities and general use. The fourth chapter describes all the commands in detail. The final chapter gives a complete demonstration of the program with three sample sessions. The directions carefully lead you through each command and procedure as you practice a sample budget. The manual also includes a glossary of terms and an index to all the topics covered.

For certain tasks, I found the program difficult to use. I expected to be able to edit the budget until I could see the whole picture. With *Disk Money Minder,* this is hard to accomplish. The program doesn't allow much flexibility in distributing deposits into the various categories, and it doesn't keep a running total of funds left to distribute. Other problems include the lack of a decimal point in dollar amounts (so they are really "cent amounts") and it has no feature to clear entries, deposits or the whole working data set, to start a new trial budget. When you try to reread a data file, the program adds to the category totals already in memory. This is fine if you are summing monthly deposits, but doesn't help if you are trying to get some sense of budget adjustments necessary.

I also had problems with the file handling capabilities of the program. Admittedly, Disk BASIC for the Color Computer doesn't give you much help. But I would like to see at least a list of files to be read. If you mistype the name of a file, the program creates a new empty file by that name and doesn't tell you that the file wasn't found. This quirk is due to the use of random access files, which are not necessary for this application.

The design of the printed summaries could also be improved. The number of entries in a category should be included, not just the balance. This avoids getting a listing of unlabeled categories with zero balances. The method for searching the check records is likewise inadequate. Only a series of check numbers is used for the search. One often needs to search by date, or for a specific party on the check. A little more work is needed in this part of the program.

My overall impression is that *Disk Money Minder* is a pretty fair home budget program, provided it meets your specific idea of the budgeting process. However, it isn't adaptable to many unanticipated needs. Balancing a checkbook is easier with a program designed specifically for that purpose. Setting up a budget and exploring various alternatives is easier with a spreadsheet program which gives you complete flexibility in experimenting with ways to spend your money.

(Harmonycs, P.O. Box 1573, Salt Lake City, Utah 84110, 32K disk, $19.95)

—Stuart Hawkinson

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If you've just written a BASIC or machine language program or have a data file and want to get it over to your friend's house as quickly as possible, do you worry about snow storms, the fragile state of your cassette in the mail or if a certain employee of the post office might eat your data for lunch? Well, here is a "Pony Express" system for your data transmission that can't be beat.

The name of this workhorse is *Direct File Transfer (DFT)*. It is a machine language utility program which will handle the complete uploading and downloading of any type of data or program that you could possibly have including BASIC, machine language, ASCII, data text files, etc., to another CoCo running *DFT*. What makes this program so excellent is that you do not have to set up any parameters or define the length of your file or specify what kind of data you are going to send. *DFT* will figure it all out for you. With other programs that do this sort of thing, you must know the load, end and exec address of your ML files. That is not the case here. *DFT* will take care of everything. This utility is divided into a few different parts which I will explain separately.

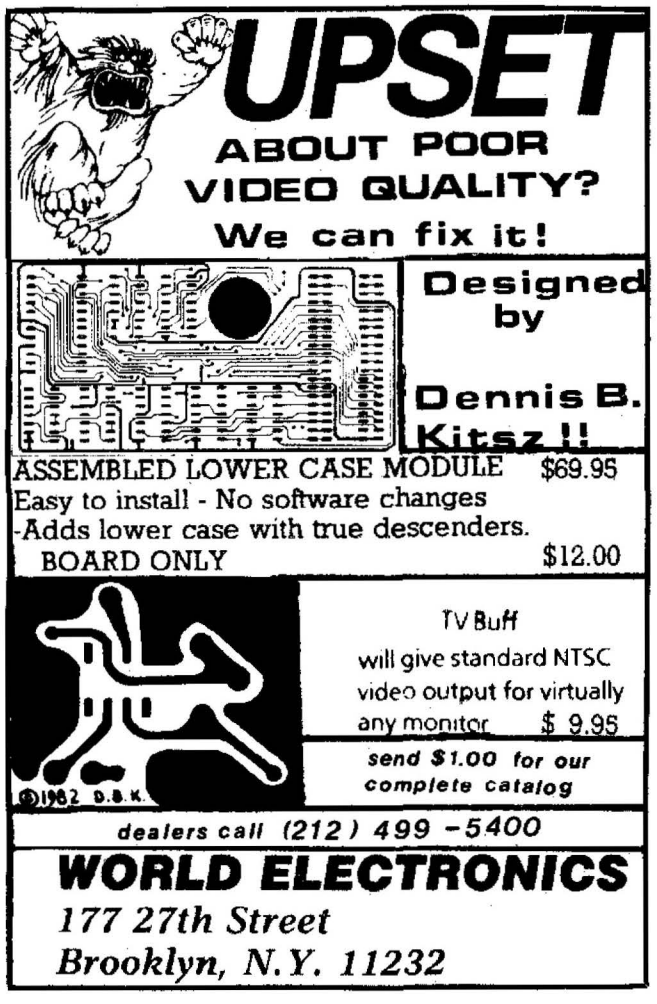
The heart of *DFT* lies in the ability to send *any* type of program over the phone lines with the use of a modem. Think about this: an ASCII file from a word processor, a game you wrote, a mailing list, etc. What if you have to rush out that new inventory sheet and the closest friend who has a printer lives 25 miles away? Do you cry? Do you scream? Do you kick your dog? No—with *DFT* you can send the file over the phone to a friend who has the printer and he can do it! No wait. No lines. No four days later...no Excedrin headache.

When you load the program from disk all paramaters are set up for the most popular configurations (300 Baud and half duplex). Before you can send your data you must choose option 5 and load into your buffer the data that you wish to send from tape or disk. You can send a file straight off disk without loading it into your buffer first but it is not recommended. Once loaded, the bottom of your screen will state that this was done successfully and what type of program it is. If you have a bad file you will get an I/O error. If you so choose you can change from half duplex to full duplex for special needs on other systems. When you have the desired material in your buffer you can go into the transmission mode and begin.

This is the procedure for sending (or receiving) a file. Once you place your call in the usual fashion and when you are both set up it must be determined who will place their modem in "originate" and who in "answer." (This is the most difficult part in using *DFT*!) When this is done and both parties have turned on their modems you can hang up the phone and select the send or receive option. *DFT* will take it from here. The program will first wait for an "inquiry" from the sender and an "acknowledgement" from the receiver before proceeding. After this you are in "sync" and your data begins its journey over the phone lines in blocks (batches of 255 bytes). In the upper right hand portion of your screen there is a black cursor signaling each block as it is being sent. Also the program will inform you "sending block 6...receiving block 14..." on the screen. Now listen to this: If there is some noise on the line, or your sister picks up the phone to order a pizza, *DFT* will resend the block and so advise you visually! This means that there can be no errors in your transmission because the program monitors itself to see that each block of data that is received is the same as the original one that is sent from the opposite end! No errors ever! You can even be out of the room and *DFT* will "signal" you with an audible beep when the file transmission is finished! This is a nice touch, seeing that a long file can take 10 or more minutes to complete. So, you can be elsewhere during transmission and the program makes sure all is okay. After the complete file has been sent, each party will be advised of a "normal transmission" and it will "page" you back. You can then save the received data to tape or disk with option 6 as many times as you like. You can load your file from tape or disk likewise.

Another feature of *DFT* is the "chat mode" similar to that found on the CB section of Compuserve. With this you can type back and forth to another computer. The chat mode also allows the user to use the program as a communications terminal, wherein you can communicate with bulletin boards such as The Electronic Rainbow. I, however, did not try this function, since I use a smart terminal package for this.

File transmission to another TRS-80 such as the model I or model III can also be accomplished because *DFT* does internal conversions of the BASIC "tokens." However *please* do not misunderstand this to mean that you can download a file into your buffer from another computer and



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then run it. Yes, you can receive the data from, let's say a model III, but it is not guaranteed to run. Screen locations are different, graphics, etc. If you receive a machine language file from another computer it is guaranteed NOT to run but to lock up your computer; however *DFT* will handle the transmission aspect of it.

Other options include the ability to inspect your disk directory and see what is on any given disk and how many free granules you have. Option 8 will end *DFT* and return to BASIC. Another feature is the "bell" which you can sound by pressing the clear key. This is useful to get the attention of the party of the opposite end. Also, you will hear the bell when a file is finished transmitting. If for some reason you wish to abort the transmission, you can do so by pressing the break key and each party will be so advised by a message on the screen stating who requested the abort.

As an added bonus there is another program on the disk that is not included with the tape version. It's called "Fconv" or file convert. This is another utility with which you can convert a binary file to ASCII/Hex format and vice versa. It also allows you to compute the checksum of a specific file.

DFT is truly an outstanding communications package that will handle all of your file transmission needs. Rarely have I come across such a complete piece of work. The program is *very* user friendly and you are always informed of everything that is happening with screen prompts. If you never sent a file over the phone lines before, this utility will make you feel comfortable and in charge while at the same time handling all the complex functions that a program like this entails. The documentation is an informative 15 half-pages with a nice outer cover. The disk is not protected which is important for backup purposes. And the price of this utility makes it one of the best buys on the software market. With *DFT* you can't go wrong. This program also comes in a tape version which is identical to this except for the disk commands.

The only minor problem I came across was when I loaded a BASIC file into my buffer. The manual states that because *DFT* is made to be compatible with all TRS-80s, it must do internal conversions which may sometimes cause the computer to seem "locked-up." This is not a problem, but if you plan to load two consecutive files from tape the motor may not shut off in time and run into the second file. Anyway, you can avoid this by doing an "audio on" and listening for the pause manually, but the audio on will defeat the tone feature.

(Computer Shack, 1691 Eason, Pontiac, MI 48054, $24.95 tape, $29.95 disk)

—Steve Schechter

Software Review

Space Shuttle Simulator Requires Skill, Patience

Have you flown your computer lately? Well, you ought to try this simulator. Tom Mix has produced another fine software package called *Space Shuttle*. The graphics are quite excellent.

The program requires 32K Extended Color BASIC and is supplied on a cassette. Therein lies my only complaint. The program will not work at all if your disk drives are attached. For those of you who do not own disk drives, there is no problem. But it would be convenient to have a disk based version of the software.

The package includes a 10 page instruction manual. My first impulse, with any game, is to ignore the instructions and just try the game. Forget that! The Shuttle mission is quite complex. There is little chance of completing the maneuvers without preflight education.

The mission requires you to successfully pilot the Shuttle into orbit, park next to a malfunctioning satellite, retrieve the satellite with the robot arm, perform re-entry and landing. Performance scores are accumulated for each phase of the maneuvers. Believe me, it's not easy, even for me, an experienced commercial and instrument pilot with a flight instructor certificate. On the other hand, the neighbor kid next door didn't seem to have any more trouble than I did. Are these video games preparing our kids for careers in aviation? Maybe!

The program features a full function instrument panel and a simulated "look" out the cockpit windows. I thought the final approach to landing simulation was particularly impressive.

Interestingly, this program is *not* pure machine language. It is written in Extended Color BASIC with machine language subroutines to take care of some of the simulation. The displays are nonetheless, quite realistic.

This program was very popular at *Rainbow*fest. In fact, the Tom Mix booth was so overcrowded that I never did have a chance to meet the man. Maybe next time, Tom.

One final note: this is not your typical arcade style "shoot 'em up" game. If you are looking for an attack from Proxima Centauri, keep looking. This simulation requires considerable skill and patience.

(Tom Mix Software, 3424 College N.E., Grade Rapids, MI 49505, $28.95 tape)

—Dr. Laurence D. Preble

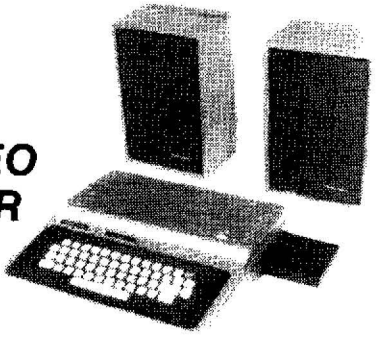
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The **STEREO COMPOSER** produces music in stereo. Of the 4 voices produced, 2 are directed to each channel. This ability alone increases the realism of the music. You can even move the voices between speakers as the music plays.

The **STEREO COMPOSER** comes assembled, tested, burned in, with all the software and hardware to allow you to immediately start enjoying your music. A complete manual and examples are provided to give you everything you need.

The **STEREO COMPOSER** is completely compatible with the Radio Shack disk system. Any expansion unit will allow you to have both a disk and the **STEREO COMPOSER** operating.

Requires Extended BASIC and Minimum of 16K

STEREO COMPOSER (Hardware, Cassette and Disk) $89.95



THE COMPOSER



The **COMPOSER** is a 4 voice music compiler which easily allows one to develop high quality music. Each voice is programmed separately. In addition, each voice uses its own waveshape table which means a unique sound for each of the 4 voices.

The **COMPOSER** features a 7 octave range. It supports dotted and double dotted notes as well as eighth, quarter, and standard triplet notes. Sixteenth and thirty second notes are also supported.

The **COMPOSER** allows the music to be played at any tempo and in any key. And believe it or not, the tempo and key can be modified as the music plays. This gives the user tremendous versatility in developing music. Key modification also allows the user to move the music up or down one or more octaves.

The **COMPOSER** displays a constantly changing random kaleidoscope pattern as the music plays. In addition, the number of the note being played is displayed which aids one in finding sour notes during music development. Both of these displays can be disabled to allow any screen to be displayed while the music is playing. In this way, one can show the words to a song or display a picture as the music plays.

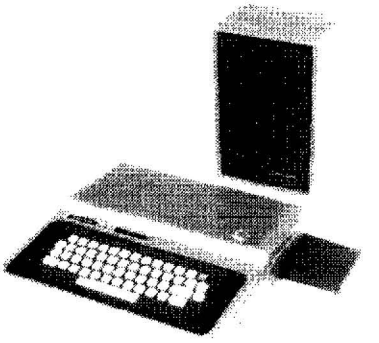
The **COMPOSER** develops a machine language position independent subroutine that can be Saved, Loaded, and Executed independent of all other software. This means that you can share your music with friends. In fact, you can write your own BASIC programs that call and play the music. Software vendors may include the music in their own product.

The **COMPOSER** is menu driven making it extremely easy and friendly to use and operate. A thick operating manual is provided as well as 20 minutes of music. Many examples are given to aid the user in getting started. All you need is provided, no additional hardware is necessary. Don't let the price fool you, the **COMPOSER** has got to be heard to be appreciated. For reviews see June '83 *RAINBOW*, p. 192 and May '83 *Color Computer News*, p. 74.

Requires Extended BASIC and Minimum of 16K

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THE VOICE



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THE VOICE is a hardware synthesizer that plugs into the cartridge slot. It uses a sophisticated integrated circuit the SC-01 by VOTRAX, to reproduce any word in English as well as other languages using phonemes. Phonemes are basic units of speech of which 64 are available at 4 inflections. This chip costs us $55. If you supply the chip deduct $55.

THE VOICE has two outputs. Speech may be heard through the TV speaker, or the built-in audio power amplifier may be connected to your own external speaker. If the volume is too high, a built-in volume control is provided.

THE VOICE comes assembled, tested, burned in, with all the necessary hardware and software. A complete manual with many examples is provided to get you started in developing your own programs.

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HIGH LOW The VOICE gives you hints in guessing a number it has picked.
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CORRECTIONS

The "64K Modification For 'D' Board" article by B. H. Alsop, which appeared in our March issue, requires one correction. In the section headed "Problems," the reader is directed to cut pin 4. The correct pin to be cut is pin 5.

* * *

In his commentary "If It's Not The 'F' Board, How About The '285'?" (June 1983), Mike Reilly forgot to mention that capacitor C64 should be removed as well as the seven other capacitors named in the article in order to convert a "285" board to 64K. If your computer already has 32K, these capacitors should already have been removed by the factory.

* * *

Reaffirmation, rather than correction. While many readers have reported various problems with William G. Franklin's "Flying The Sopwith CoCo" (June 1983), the listing *is correct* as it appears in the magazine. Most often, an OD error in line 170 has been reported. If this seems to be your problem, recheck your *DATA* statements in lines 7000, 7010 and 7020. Make sure commas aren't semicolons, etc.

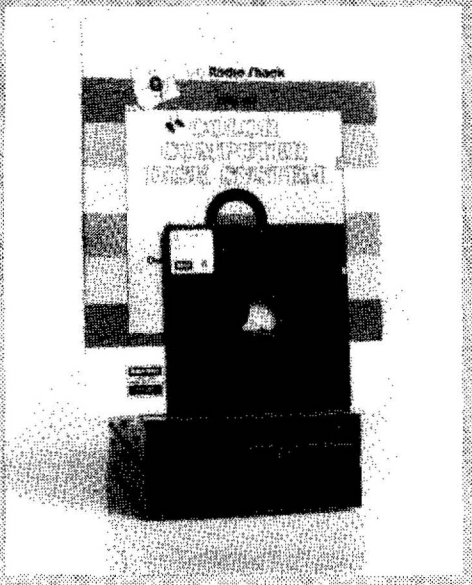
Those with disks may encounter a problem, however, in that Bill has used "AS" as a variable in lines 390, 400, 405, 410, 1190, 1510 and 8030. *AS* is a reserved word in Disk BASIC. Just rename the AS variable to something else, say VQ.

* * *

In his article, "Using *VARPTR*, BASIC's Hidden Command" (June 1983), Ron Mummaw neglected to mention that immediately after typing in the first BASIC program (the one with *DATA* statements) you should: 1) *SAVE* the program, 2) *RUN* it, and 3) press the BREAK key to get out of it. It is *only after* running the program that the A$ will change from a string of slashes to the tokenized command words. *SAVE* it *before* you *RUN* it.

Due to an error at *Rainbow*, the assembly language source code referred to in the article was omitted. That listing follows:

```
0001 0600 108E061B        LDY #TABLE      GET Y ADDR
0002 0604 8E04CE          LDX #$4CE       SCREEN LOC
0003 0607 A6A0    START   LDA ,Y+         GET CHR
0004 0609 8101            CMPA #$01       IS IT A 1
0005 060B 2605            BNE CK2         GO IF NOT 1
0006 060D 308810          LEAX 28,X       DO NEXT ROW
0007 0610 20F5            BRA START       GOTO START
0008 0612 8111    CK2     CMPA #$11       IS IT $11
0009 0614 2601            BNE PRINT       IF NOT THEN
0010 0616 39              RTS             GOTO BASIC
0011 0617 A780    PRINT   STA ,X+         PUT CHR ON SCN
0012 0619 20EC            BRA START       GOTO START
0013 061B FFFFFFFF TABLE  FCB $FF,$FF,$FF,$FF
0014 061F 01FF0000        FCB $01,$FF,$00,$00
0015 0623 FF01FF00        FCB $FF,$01,$FF,$00
0016 0627 00FF01FF        FCB $00,$FF,$01,$FF
0017 062B FFFFFF11        FCB $FF,$FF,$FF,$11
```

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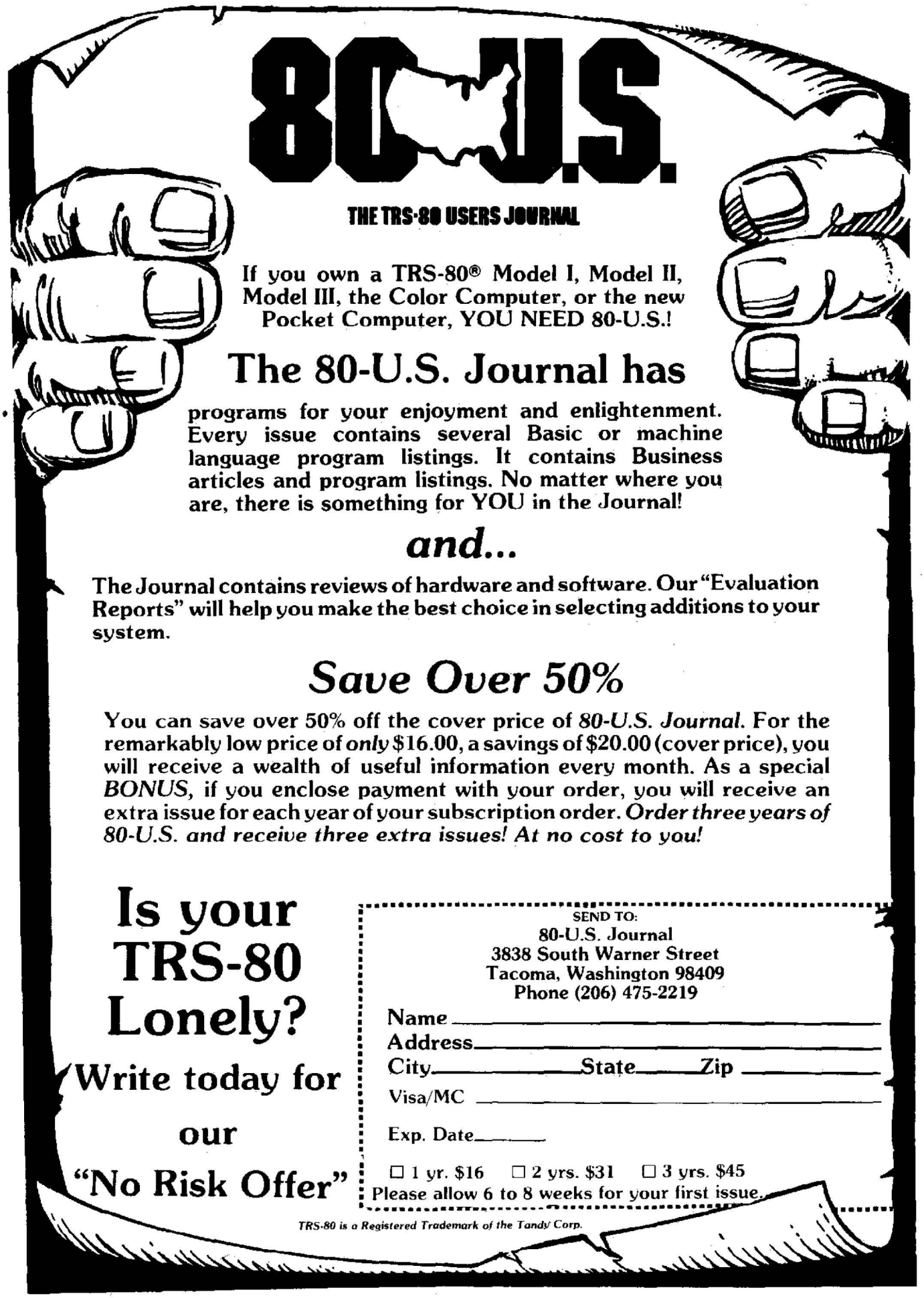
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Alter Your Programs With Revfield

By Ray Gauvreau

You've been trying to solve the Adventure *Mystery of the Haunted Laundromat* for hours. Your eyes cry for some rest but the bright green screen shows no mercy. Each time you try to move you're told "you can't go that way." By the time you figure out what to do you've forgotten just where you were, and wouldn't you know, that information has been scrolled off the top of the video screen! Finally, as a last resort, you decide to list the @#%$&!*! program to have a look at the *DATA* statements for clues. You boldly enter a *LIST* command. The program whizzes past at the speed of light while your groping fingers try in vain to reach the shift and @ keys at the same time.

Well, I've had these problems, and a little while ago I decided to do something about them. Out came my new Radio Shack *EDTASM+* and my 6809 assembly language programming book and a few short months later *Revfield* was completed. This machine language (ML) utility routine is designed to do the following:

1) Reverse video in your BASIC programs (that's green characters on a dark background)
2) Control the printing rate during the *RUNning* and *LISTing* of programs
3) Set up a "video window" (this creates a protected area on the alpha numeric screen that will not be affected when a program scrolls)

There are three program listings. Listing 1 is a BASIC loader program which reads the machine language instructions from the *DATA* statements and then *POKEs* these numbers into high memory. Listing 2 is an object file which is to be used by those with Editor Assemblers. Both create machine language routines, but in very different ways. The third program listing is a short BASIC demonstration which allows you to see what this ML routine can do.

(For the past 17 years, Ray has been involved in the performing and visual arts as a professional musician and a studio potter. Three years ago he caught the computer bug and is now taking a computer engineering course at Sault College.)

> *"Revfield . . . is designed to reverse video in your* BASIC *programs, . . . control the printing rate during the running and listing of programs, (and) set up a 'video window'."*

The variable "ST" always refers to the start memory location of the ML routine and is typically 16160 for a 16K and 32544 for a 32K computer. All numbers described in this article are in decimal.

Creating The ML Routine with BASIC

The program of Listing 1, which is written in BASIC, creates the ML routine when it is *RUN*. It does this by reading the ML code stored in the *DATA* statements one at a time and then storing these instructions in high memory. *ENTER* this listing into your computer exactly as it appears. When finished, check what you now have in memory line by line, paying special attention to lines 180 to 370. These *DATA* statements contain the ML program and they must be exact if the routine is to operate properly. These decimal numbers are actually a program which is very unlike the BASIC programs you are probably used to. In order for it to work properly, each digit must be correct. Please spend a little time checking your work now. I assure you, it will be

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worth the effort. Before *RUNning* this loader program, save it on tape or disk. You should *CSAVE* more than one copy just in case there is a glitch or bad spot on the tape.

RUN this program answering the prompts as they appear. Once the routine has been created you will be asked how many times you would like it saved on tape. Have it saved at least twice.

For Those With Assemblers

The position independent code in Listing 2 can be keyed in using any 6809 Editor Assembler. The origin (line 50) can be changed to whatever value you wish, but be sure to *CLEAR* from this memory location when using the routine from BASIC. The JMP instruction on line 420 is followed by a dummy location. It will be replaced with a true location once the routine has been initialized. Once assembled and in memory, the routine can be *EXECuted* directly from the assembler. With the Radio Shack *EDTASM+* the RTS in line 160 must be replaced with a SWI instruction. This tells the program to return to the assembler after initialization. Save a couple of copies of both the object code and the assembled code on tape. The length of the file is 191 bytes.

The Demonstration Program, In BASIC

Key in this BASIC demonstration program (BDP) accurately, then check it line by line for errors, paying special attention to lines 40, 80, 90, 160 and 170. Now save a copy of this on tape. Congratulations, you are now ready to try out this Demo on the machine language routine. The first thing you must do is protect the area of memory where the ML routine is to go. Do this by typing *CLEAR 200,16160 ENTER* for a 16K computer, or *CLEAR 200,32544 ENTER* for a 32K machine. Now load in the ML routine you have saved on tape. Do this by typing *CLOADM "REVFIELD" ENTER*. Don't worry about the BASIC Demo program. It will be left unharmed by loading this machine language program. With the ML routine now in place you can *RUN* the BASIC demonstration program.

It's a good idea to keep Listing 3 in front of you as the Demo runs. Try to correlate what you see on the screen with what you read in the listing. Answer the first prompt with the correct memory size for your computer. The next thing that should happen is that the screen will clear to dark green. This occurs every time an "EXEC ST" is encountered in your BASIC code (see line 50). The variable "ST" equals the location of the ML routine set in line 40. The *BREAK* key will completely disable the routine any time you wish; however, it may be necessary to hold this key down until an entire string of data has been completely printed on the screen. This function can be disallowed by a simple *POKE ST+54,0*.

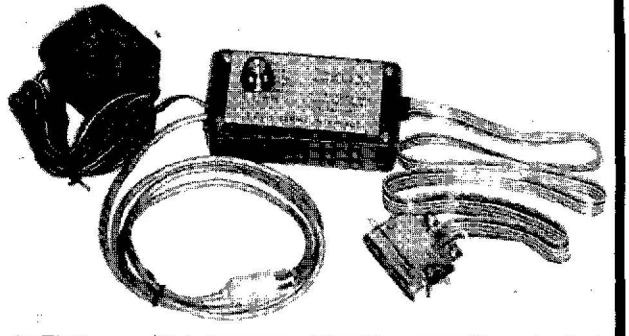
The print speed is set by the number in memory location ST+121. Any number between 0 and 255 can be *POKEd* into this location. However, numbers greater than 80 result in a print speed that is painfully slow. Once this value is set, it remains so until *POKEd* with another number.

The value for the end of the protected window area is held in memory locations ST+130 and ST+131, the most significant bit (MSB) and the least significant bit (LSB) respectively. Lines 130 and 140 input a screen location which correspond to the print @ location (see page 277 of your "Getting Started With Color BASIC" manual). The value is then checked at line 150 to see that it is within the limits of the screen. Then line 160 converts your number to the MSB and LSB which are *POKEd* into memory locations ST+130 and ST+131 on line 170.

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In Your BASIC Programs

This ML routine can be added to your BASIC programs by appending lines 50 to 80 and 160 to 370 from Listing 1, or the routine can be loaded in by a *CLOADM* before *RUNning* your BASIC program. A simple *EXEC* command can be used every time you wish to clear the screen. The print speeds can be varied throughout as well as the "window" size being changed within a running program.

Having the routine operating while writing your programs is most helpful because of the ease on your eyes and the control of the printing speed. BASIC code could have been used to create these screen features but this could only have been used while the BASIC program was running. Much more memory would have been required and it would not be as user transparent or automatic.

Listing 1:

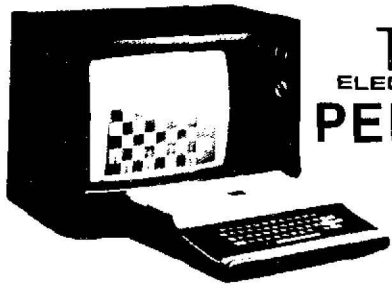
```
140.....0203
220.....0372
END.....0627
```

```
10 CLS:PRINT"THIS PROGRAM POKES
THE ROUTINE  INTO HIGH MEMORY":P
RINT
20 PRINT" DO YOU HAVE -":PRINT,"
1) 16K":PRINT,"2) 32K"
30 INPUT " CHOOSE 1 OR 2";K
40 IF K=2 THEN CLEAR 200,32544 :
ST=32544 :ELSE CLEAR 200,16160 :
ST=16160
50 FOR L=ST TO ST+191
60 READ D
70 POKE L,D
80 NEXT L
90 CLS:PRINT"THE ROUTINE IS NOW
READY TO BE  SAVED TO TAPE. INSE
RT A BLANK   TAPE PRESS RECORD A
ND PLAY"
100 INPUT"WHEN READY ENTER THE N
UMBER OF  TIMES YOU WISH TO SAVE
 IT";N
110 FOR T=1 TO N
115 PRINT"SAVING COPY";T"OUT OF"
;N
120 CSAVEM"REVFIELD",ST,ST+191,S
T
130 MOTORON:FOR R=1 TO 500:NEXT
R
140 NEXT T:MOTOROFF:PRINT
150 PRINT"THE PROGRAM IS NOW SAV
ED WITH A STARTING LOCATION OF";
ST
160 PRINT"AND AN ENDING LOCATION
 OF"ST+191
170 PRINT"THE EXEC ADDRESS IS";S
T
180 DATA 52, 54, 141, 26, 48, 14
1, 0, 40, 188, 1
190 DATA 104, 39, 14, 16, 190, 1
, 104, 191, 1, 104
200 DATA 48, 141, 0, 61, 16, 175
, 132, 53, 54, 57
210 DATA 16, 142, 2, 0, 142, 4,
```


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```
0, 159, 136, 134
220 DATA 32, 167, 128, 49, 63, 3
8, 250, 57, 52, 52
230 DATA 246, 1, 84, 193, 191, 3
9, 38, 158, 136, 129
240 DATA 8, 39, 41, 129, 13, 39,
 87, 129, 64, 37
250 DATA 16, 129, 96, 37, 42, 14
0, 6, 0, 38, 2
260 DATA 141, 47, 53, 52, 126, 1
7, 17, 167, 128, 159
270 DATA 136, 134, 10, 32, 236,
174, 141, 255, 242, 191
280 DATA 1, 104, 32, 227, 16, 14
2, 32, 32, 16, 175
290 DATA 130, 159, 136, 134, 10,
 32, 221, 128, 64, 16
300 DATA 142, 1, 1, 49, 63, 38,
252, 32, 214, 142
310 DATA 4, 0, 230, 136, 32, 231
, 128, 140, 5, 224
320 DATA 38, 246, 159, 136, 198,
 32, 231, 128, 140, 6
330 DATA 0, 38, 249, 57, 150, 13
7, 129, 32, 37, 4
340 DATA 128, 32, 32, 248, 198,
32, 231, 128, 140, 6
350 DATA 0, 38, 4, 141, 210, 32,
 7, 76, 129, 32
360 DATA 38, 238, 159, 136, 53,
52, 198, 1, 134, 10
370 DATA 32, 148
```


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Listing 2:

```
                    00010 * RAY GAUVREAU
                    00020 * PRINT REVERSE FIELD
                    00030 * CREATE PROTECTED WINDOW
                    00040 * PRINT DELAY
3F20                00050          ORG $3F20
3F20 34   36        00060 START    PSHS X,Y,D
3F22 BD   1A        00070          BSR BLC
3F24 30   8D 0028   00080          LEAX PRINT,PCR
3F28 BC   0168      00090          CMPX $168
3F2B 27   0E        00100          BEQ FPULL
3F2D 10BE 0168      00110          LDY $16B
3F31 BF   0168      00120          STX $168
3F34 30   8D 003D   00130          LEAX 1+RETURN,PCR
3F38 10AF 84        00140          STY ,X
3F3B 35   36        00150 FPULL    PULS X,Y,D
3F3D 39             00160          RTS
3F3E 108E 0200      00170 BLC      LDY #$200
3F42 8E   0400      00180 CLRIT    LDX #$400
3F45 9F   88        00190          STX $88
3F47 86   20        00200          LDA #$20
3F49 A7   80        00210 CLSNX    STA ,X+
3F4B 31   3F        00220          LEAY -1,Y
3F4D 26   FA        00230          BNE CLSNX
3F4F 39             00240          RTS
3F50 34   34        00250 PRINT    PSHS B,X,Y
3F52 F6   0154      00260          LDB $154
3F55 C1   BF        00270          CMPB #$BF
3F57 27   26        00280          BEQ BRKEY
3F59 9E   88        00290          LDX $88
3F5B 81   08        00300          CMPA #$8
3F5D 27   29        00310          BEQ BACKSP
3F5F 81   0D        00320          CMPA #$0D
3F61 27   57        00330          BEQ ENTER
3F63 81   40        00340          CMPA #$40
3F65 25   19        00350          BLO BLACK
3F67 81   60        00360          CMPA #$60
3F69 25   2A        00370          BLO GREEN
3F6B 8C   0600      00380 PULL     CMPX #$600
3F6E 26   02        00390          BNE PULL2
3F70 8D   2F        00400          BSR SCROLL
3F72 35   34        00410 PULL2    PULS B,X,Y
3F74 7E   1111      00420 RETURN   JMP $1111
3F77 A7   80        00430 BLACK    STA ,X+
3F79 9F   88        00440 FIXCUR   STX $88
3F7B 86   0A        00450          LDA #$0A
3F7D 20   EC        00460          BRA PULL
3F7F AE   8D FFF2   00470 BRKEY    LDX $1+RETURN,PCR
3F83 BF   0168      00480          STX $168
3F86 20   E3        00490          BRA PULL
3F88 108E 2020      00500 BACKSP   LDY #$2020
3F8C 10AF 82        00510          STY ,-X
3F8F 9F   88        00520          STX $88
3F91 86   0A        00530          LDA #$0A
```

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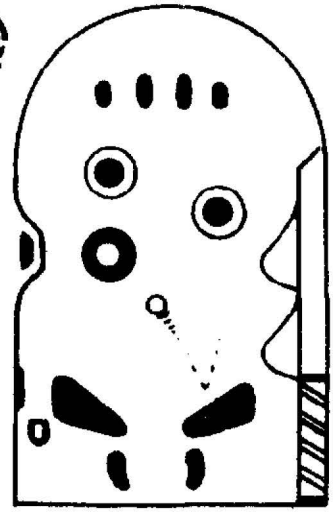
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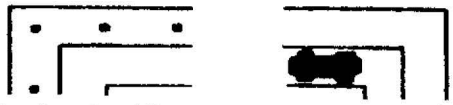


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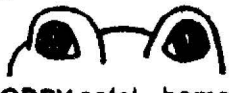


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```
3F93 20  DD      00540          BRA PULL2
3F95 80  40      00550 GREEN    SUBA #$40
3F97 108E 0101   00560          LDY #$0101
3F9B 31  3F      00570 DLAY     LEAY -1,Y
3F9D 26  FC      00580          BNE DLAY
3F9F 20  D6      00590          BRA BLACK
3FA1 8E  0400    00600 SCROLL   LDX #$400
3FA4 E6  88 20   00610 NXSCRO   LDB $20,X
3FA7 E7  80      00620          STB ,X+
3FA9 8C  05E0    00630          CMPX #$5E0
3FAC 26  F6      00640          BNE NXSCRO
3FAE 9F  88      00650          STX $88
3FB0 C6  20      00660          LDB #$20
3FB2 E7  80      00670 FINSCR   STB ,X+
3FB4 8C  0600    00680          CMPX #$600
3FB7 26  F9      00690          BNE FINSCR
3FB9 39          00700          RTS
3FBA 96  89      00710 ENTER    LDA $89
3FBC 81  20      00720 COMP1    CMPA #$20
3FBE 25  04      00730          BLO ENT1
3FC0 80  20      00740          SUBA #$20
3FC2 20  F8      00750          BRA COMP1
3FC4 C6  20      00760 ENT1     LDB #$20
3FC6 E7  80      00770          STB ,X+
3FC8 8C  0600    00780          CMPX #$600
3FCB 26  04      00790          BNE INCRE
3FCD 8D  D2      00800          BSR SCROLL
3FCF 20  07      00810          BRA GOOIT
3FD1 4C          00820 INCRE    INCA
3FD2 81  20      00830          CMPA #$20
3FD4 26  EE      00840          BNE ENT1
3FD6 9F  88      00850 FINIT    STX $88
3FD8 35  34      00860 GOOIT    PULS B,X,Y
3FDA C6  01      00870          LDB #$1
3FDC 86  0A      00880          LDA #$0A
3FDE 20  94      00890          BRA RETURN
         0000    00900          END
```

90..... 01E5
END...03CC

Listing 3:

```
10 CLS:PRINT"BEFORE RUNNING THIS
 DEMO BE SUREYOU HAVE THE ROUTIN
E LOADED IN  MEMORY AT 16160 OR
32544":PRINT
20 PRINT" DO YOU HAVE -":PRINT,"
1) 16K":PRINT,"2) 32K"
30 INPUT " CHOOSE 1 OR 2";K
40 IF K=2 THEN CLEAR 200,32544 :
ST=32544 :ELSE CLEAR 200,16160 :
ST=16160
50 EXEC ST
60 PRINT"THIS ROUTINE CAN BE COM
PLETELY  REMOVED FROM OPERATION
ANY TIME YOU WISH BY PRESSING TH
E BREAK":PRINT
70 INPUT"INPUT A NUMBER BETWEEN
0 AND 255FOR THE PRINT SPEED";SP
80 IF SP<0 OR SP>255 THEN PRINT"
***** SPEED OUT OF RANGE ******"
:GOTO 70
90 POKE ST+121,SP
100 PRINT"***SPEED NOW SET ***":
PRINT
110 PRINT"TO CLEAR THE SCREEN AT
 ANY TIME SIMPLY USE THE EXEC CO
MMAND IN  YOUR PROGRAM":INPUT"PR
ESS ENTER TO CONTINUE";A$
120 EXEC
130 PRINT"INPUT A SCREEN LOCATIO
N BETWEEN 0 AND 479"
140 INPUT"THIS WILL RESERVE A PR
OTECTED  WINDOW ABOVE THIS LOCA
TION";W
150 IF W<0 OR W>479 THEN PRINT"I
NVALID SCREEN LOCATION !":GOTO 1
30
160 M=FIX(W/256) : L=W-M*256:M=M
+4
170 POKE ST+130,M :POKE ST+131,L
180 LIST
190 'ST = START OF THE ROUTINE
     EITHER 16160 FOR 16K
            32544 FOR 32K
200 END
```


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2) COMPARE EPROM TO RAM!
3) BLOCK PROGRAMMING!
4) BYTE PROGRAMMING!
5) DUMP EPROM TO RAM!
6) JUMP!

Firmware is "stack-oriented", "position independent", and "menu driven". Supplied in an EPROM, it can also be stored on disc or tape for execution from RAM if desired.

STANDARD HARDWARE FEATURES

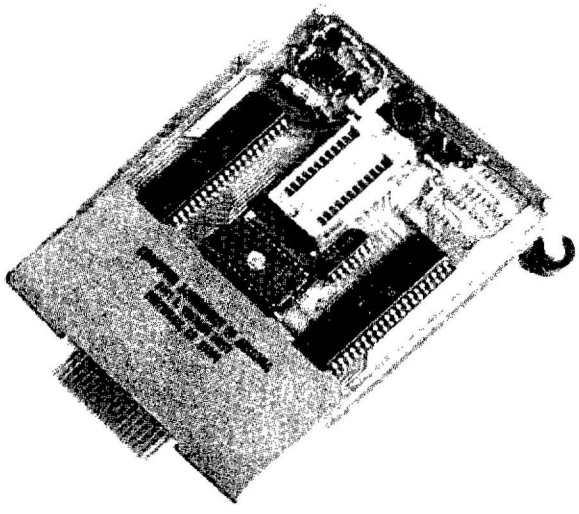
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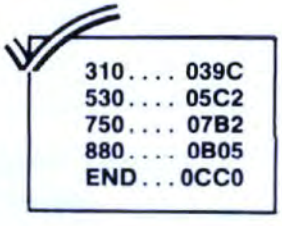
Could there be a fortune waiting for you in this locked safe? To find out, all you need is the CoCoCombination. That might take a little time, though, so you'd better. . .

`GET CRACKING´

By Ted Hasenstaub

For those of you who enjoy guessing games, Theodore Hasenstaub's *Safecracker* is a program which allows you to guess the three numbers of a combination that will open a safe for you. The graphics and sound are good quality.

To use *Safecracker,* simply *CLOAD* and *RUN* the program. After the title screen, the program prompts for your name and the number of tries you would like in order to figure out the safe's combination. The safe has three numbers in its combination from 1 to 63. They could be all the same. To change the numbers on the dial simply move the right joystick slowly to the left or right. As the dial turns, you will hear a clicking sound. When the number you want appears, press the joystick button until you hear a tone. Release the button quickly or you will get three tones and it will register this as your first guess at all three numbers. The screen will then display your three guesses, and give you hints as to how you fared. I think you will enjoy this program, so get "cracking."



```
310.... 039C
530.... 05C2
750.... 07B2
880.... 0B05
END...0CC0
```

The listing:

```
10 'SAFECRACKER
20 '
30 'BY:TED HASENSTAUB
40 '4/11/83
50 '
60 CLS
70 CLEAR 600
80 DIM N$(10),A$(10)
90 N$(0)="R4U6L4D6BR9":'0
100 N$(1)="BR1R4BL2U6G1BR6BD5":'
1
110 N$(2)="BU5U1R4D2G4R4BR3":'2

120 N$(3)="R4U3NL2U3L4BR8BD6":'3
130 N$(4)="BR4U6BL4D3R3BD3BR5":'
4
140 N$(5)="R4U3L4U3R4BR4BD6":'5
150 N$(6)="R4U3L4U3D6BR8":'6
160 N$(7)="BR4U6L4D1BD5BR8":'7
170 N$(8)="U6R4D3NL3D3L3BR7":'8
180 N$(9)="BR5U6L4D3R3BD3BR5":'9
190 A$(0)="U8R8D8L8BR12":'0
200 A$(1)="BU4U4R8BD4L8BR8D4L8BR
12":'S
210 A$(2)="U8R8D4L8BR4F4BR4":'R
220 A$(3)="U8BR8G4L4BR4F4BR9" :'
K
230 A$(4)="U8R8BD4L8BD4R8BR4":'E
240 A$(5)="U8F4E4D8BR4":'M
250 A$(6)="U8R8BD8L8BR12":'C
260 A$(7)="U8R8D4L8BR8D4BR4":'A
270 A$(8)="BR10":'SPACE
280 A$(9)="U8R8BD4L8BD4BR12":'F
290 SA$=A$(7)+A$(6)+A$(5)+A$(4)+
A$(8)+A$(1)+A$(7)+A$(9)+A$(4)+A$
(8)+A$(6)+A$(0)
300 XX$=A$(1)+A$(7)+A$(9)+A$(4)+
A$(6)+A$(2)+A$(7)+A$(6)+A$(3)+A$
(4)+A$(2)
310 GOSUB890
320 CLS
330 D1=RND(62)+1:D2=RND(62)+1:D3
```

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ESCAPE

A 3-D GRAPHICS ADVENTURE WITH SOUND
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16K BASIC $18.95

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This program permits storage of your favorite recipes for retrieval by your computer. Once a recipe has been recalled, then the computer can adjust the ingredient measure for serving the desired number of persons. Each recipe can contain special comments on preparation as well as the full instructions for using the recipe. Included is a line oriented text editor for creating and editing the variable length files. Completely menu driven and very user friendly. Easily modified by the user for use in keeping track of record, coin or stamp collections or whatever your interest. Screen or printer output.

16K Ext. BASIC $21.95

SPECIAL: *A collection of 30 recipies covering main meals to snacks. Only $3.95 with program.*

SQUIRE

SQUIRE is a challenging game of asset management. The player must manage a country estate and contend with crop failure, investment losses, taxes and other such headaches. The object of the game is to increase the estate's value while providing for the peasant workers. The starting assets are computer selected so that each game offers different challenges. Great experience for the kids or aspiring executives.

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```
=RND(62)+1
340 G=0
350 PMODE4,1:PCLS
360 P=0:Q=0:R=0
370 DRAW"S4;BM48,15;R122F24L122H
24D130F6U8F12D8F6U130BD6BR6R110D
110L110U110BL6D124R6U8R112D8H6U2
D2F6R4U130"
380 DRAW"BM184,64;R4D10L4U10"
390 DRAW"BM184,126;R4D10L4U10"
400 CIRCLE(132,105),20,1
410 CIRCLE(132,105),9,1
420 CIRCLE(90,105),4,1
430 DRAW"BM88,108;D14R4U14"
440 DRAW"S3;BM82,60;"+SA$
450 SCREEN1,1
460 X=JOYSTK(0)+1:IF X=64 THEN X
=63
470 IF PEEK(65280)=126 OR PEEK(6
5280)=254 THEN GOTO 670
480 IF B=X THEN 540
490 IF B>X THEN S=(B-X)/4 ELSE I
F B<X THEN S=(X-B)/4
500 FOR C=1 TO S
510 SOUND 255,1
520 FOR D=1 TO 10:NEXT
530 NEXT C
540 B=JOYSTK(0)+1:IF  B=64 THEN
B=63
550 I=INT(B):S$=STR$(I)
560 IF VAL(S$)>9 THEN GOTO 620
570 H=ABS(I)
580 DRAW"C5;S4;BM130,94"+N$(H)
590 FORV=1TO 355:NEXT:
600 DRAW"C0 ;BM130, 94"+N$(H)
610 GOTO 460
620 B1=VAL(LEFT$(S$,2)):B2=VAL(R
IGHT$(S$,1))
630 DRAW"C5;S4;BM126, 94"+N$(B1)
+N$(B2)
640 FOR V=1 TO 355:NEXT
650 DRAW"C0;BM126, 94"+N$(B1)+N$
(B2)
660 GOTO 460
670 SOUND 200,8
680 IF P=0 THEN P=B:GOTO 460
690 IF Q=0 THEN Q=B:GOTO 460
700 IF R=0 THEN R=B:G=G+1
710 SCREEN0,0
720 CLS
730 PRINT@71,"RESULTS OF TRY #";
G
740 IF P=D1 AND Q=D2 ANDR=D3 THE
N GOTO 1020
750 '
760 IF P=D1 THEN PRINT@133,"1RST
 #";P;" IS CORRECT" ELSE IF P>D1
 THEN PRINT@133,"1RST #";P;" IS
TOO LARGE" ELSE PRINT@133,"1RST
#";P;" IS TOO SMALL"
```


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By Cary D. Perttunen

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Utica, MI 48087

```
770 IFQ=D2 THEN PRINT@197,"2ND
#";Q;" IS CORRECT" ELSE IF Q>D2
THEN PRINT@197,"2ND  #";Q;" IS T
OO LARGE" ELSE PRINT@197,"2ND  #
";Q;" IS TOO SMALL"
780 IF R=D3 THEN PRINT@261,"3RD
 #";R;" IS CORRECT" ELSE IF R>D3
 THEN PRINT@261,"3RD  #";R;" IS
TOO LARGE" ELSE PRINT@261,"3RD
#";R;" IS TOO SMALL"
790 IF G=AT THEN PRINT@321,"THAT
 WAS YOUR LAST TRY ";NM$
800 IF AT=G THEN PRINT@386,"THE
CORRECT COMBINATION WAS"
810 IF AT=G THEN PRINT@426,D1;D2
;D3:GOTO 1050
820 IF G>=1 THEN PRINT@450,"YOU
HAVE";(AT-G);"TRY(S) LEFT ";NM$
830 PRINT@484,"PRESS <C> KEY TO
CONTINUE"
840 Q$=INKEY$:IF Q$="" THEN GOTO
 840
850 GOTO350
860 PMODE4,1:SCREEN 1,1:PCLS
870 DRAW"S4;BM48,15;R122F24L122H
24D130F6U8F12D8F6U130BD6BR7R110F
40D101L4U101R4BL5H40D101F40H40BU
108BR10D10BD 99BL12L102U102BL6BD
124R8U10R102D10R6U16BD16BL6H8BU2
2BR6H21U72BD72L78"
880 GOTO880
890 PMODE 3,1:PCLS
900 DRAW"BM20,100;"+XX$
910 CIRCLE(180,100),55,2
920 CIRCLE(180,100),15,2
930 DRAW"S8;C7;BM167,70;"+N$(3)+
N$(7)
940 SCREEN1,1
950 FOR Q=1 TO 5:FOR W=1 TO A:SO
UND 255,1:A=RND(9)+4:NEXT W:FOR
T=1 TO 150:NEXT T:NEXT Q
960 SCREEN 0,1
970 PRINT"ENTER YOUR FIRST NAME"
980 INPUT NM$
990 PRINT"ENTER NUMBER OF TRY(S)
 ";NM$
1000 INPUT AT:IF AT<1 THEN AT=1
1010 RETURN
1020 CLS:PRINT@132,"CONGRATULATI
ONS ";NM$:
1030 PRINT@195,"YOU HAVE SOLVED
THE SAFES"
1040 PRINT@258,"COMBINATION IN";
G;"ATTEMPTS!"
1050 FOR Q=1 TO 4000:NEXT:GOTO 6
0
```


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Turn Your CoCo Into A Pool Parlor With *8-Ball*

Eight-Ball is a very realistic computer simulation of the popular pool game of the same name. The game is played in real time, using joysticks and the computer keyboard to control the game. The joystick is used to select the angle you wish to hit the cue ball. A solid line projecting from the cue ball indicates the position of the cue stick. A blinking line radiating from the cue ball shows the projected path of the cue ball. These lines help you aim the shot. As in a real pool game, aiming distant shots is more difficult than lining up for close shots. After selecting the desired angle, push the fire button to lock in the angle. At this time, a circle with a dot and a *power-bar* indicator will be displayed above the pool table. The circle represents the cue ball. You can position the dot, using your joystick, to the desired position you wish to strike the cue ball. This allows you to put English (spin) on the cue ball. For example: Positioning the dot at the top center of the circle causes the cue ball to have forward or overspin. English is transferred to any balls which the cue ball strikes. After selecting the desired English, press and hold the fire button. The *power-bar* indicator is now activated. Release the fire button when the desired striking force is indicated. Randomly, the cue ball is struck before you release the fire button. This simulates mis-hitting the cue ball.

Pressing the *ENTER* key starts a new game after completing a game. Hitting the R key will stop an in progress game, "rack" the balls and start a new game. The V key turns on or off the cue stick line during the aiming portion of your shot. Pressing the *BREAK* key restarts the current shot routine. This allows you to select a new shot angle and English. *8-Ball* is designed for two player use; however, pressing the *spacebar* forces a change of turns. This allows the game to be played by one person.

Most standard *8-Ball* rules apply to this game. If no balls are struck on the break, play will be switched to the other player. After the first ball is sunk, the computer identifies the player with the solid color balls and the player with the striped balls. If you fail to sink one of your balls, play reverts to your opponent. A player loses his/her turn and one ball is returned to the pool table when the cue ball goes into a pocket (scratches). A player loses the game if he/she sinks the 8-ball before sinking all of his/her own balls or if a player scratches while attempting to sink the 8-ball. You can win the game by sinking all of your balls and then sink the 8-ball before your opponent does.

Eight-Ball has very good high resolution color (black, blue, orange and buff) graphics. The sound effects are good. Ball reaction and movement is excellent. This game requires the use of Radio Shack joysticks or equivalent. WICO joysticks do not work with this game. I am not your average pool player. As a matter of fact, I have not played a game of pool in years. I can honestly say I enjoyed playing this game. *Eight-Ball* is another good addition to the growing Color Computer library of software.

At the present time, *8-Ball* is only available in ROM Pack. The *8-Ball* ROM Pack seems to be constructed to the same excellent standards found on Radio Shack ROM Paks. A well written instruction booklet explains the operation of the game. *Eight-Ball* is produced by ANTECO Software and can be bought only through dealers. See ANTECO Ad in *the Rainbow*.

(ANTECO Software, Inc., P.O. Box 14728, 4220 Clay Ave., Fort Worth, TX 76117, 16K, $29.95 on ROM Pack)

—Gabriel Weaver

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Klendathu: Arachnoid War With Good Graphics, Sound

In trying to come up with a new program for the CoCo community, there are several ways that you could go about it. You could come up with an original idea, or try to "build a better mouse trap" out of an existing one. You could also adapt a game or pastime to CoCo, without having to strain your brain (I've done this before, and found it to be the easy way out). A more creative approach, however, would be to adapt a theme from a movie, or better yet, a book.

Klendathu, one of the latest cassette based offerings from the Shack, is one of the more creative programs to come along in a while. It is based on the novel "Starship Troopers," by Robert A. Heinlein, which tells the story of infantrymen of the future.

You are a trooper in the mobile infantry. Your mission is to search out and destroy all of the enemy bugs (spiders) on the planet Klendathu, before they gain strength and overrun the Federation. The bugs have burrowed their way deep into the core of the planet, so you will have to rely on your spatial sensors to seek them out. Your "power suit" has all the firepower you will need, and enough energy to repel a substantial onslaught. Don't get overconfident, though, because the bugs have you outnumbered by about 1,000 to one. Your mission is not without its rewards, however. There is extra pay for each bug that you kill, and some quick field promotions are a definite possibility. Your orders have just come through: "No prisoners are to be taken. Destroy all bugs on sight."

When the program is *RUN*, the title screen appears, and you get your first glimpse at the bugs as they march their way down the screen. You then choose from two difficulty levels, and five different periods of time to be spent on the planet's surface. When you get to the surface, and have found some bugs, you are ready to do battle.

The bugs begin to appear slowly at first, but soon begin to swarm. Before you have a chance to orient yourself, they are all over the place. The warrior bugs are the only ones that fire upon you, and it uses up your energy as they do. If they get close enough to you, they can kill you. The queen bug is worth the most amount of money, but she is always escorted by several warriors. If things get too hot to handle, you can retreat for a while, but you will lose time in the process. In order to kill the bugs, you must get right up to them and activate your torch. This was the part of the game I felt was too realistic. Not only do the bugs stop dead in their tracks when torched, but they writhe in pain as they are burned to a crisp. A little too gruesome for a game, if you ask me. It was this realism that got to me, since I have certainly killed my share of space invaders without a problem.

Meanwhile, you have to make sure that you have enough time and energy to make it back to your ship before it takes off without you. If you run out of either, you will have "bought the farm." When you do make it back to the ship, your energy and time are renewed, and you are ready for another encounter.

Klendathu is a very good game, with excellent graphics and sound effects. Although it is written in BASIC, you would never know it because of the machine language subroutines used. The documentation is the best I have ever seen for a game, and includes a nice background of the story on which it is based. If you have small children around the house, you might want to keep this one away from them. Otherwise, it can be enjoyed by all, in the spirit I'm sure it is intended. Funny, I didn't notice any cobwebs.

(Available at Radio Shack, Cat. No. 26-2567, 16K, tape, $14.95)

—Gerry Schechter

Submitting Material To the Rainbow

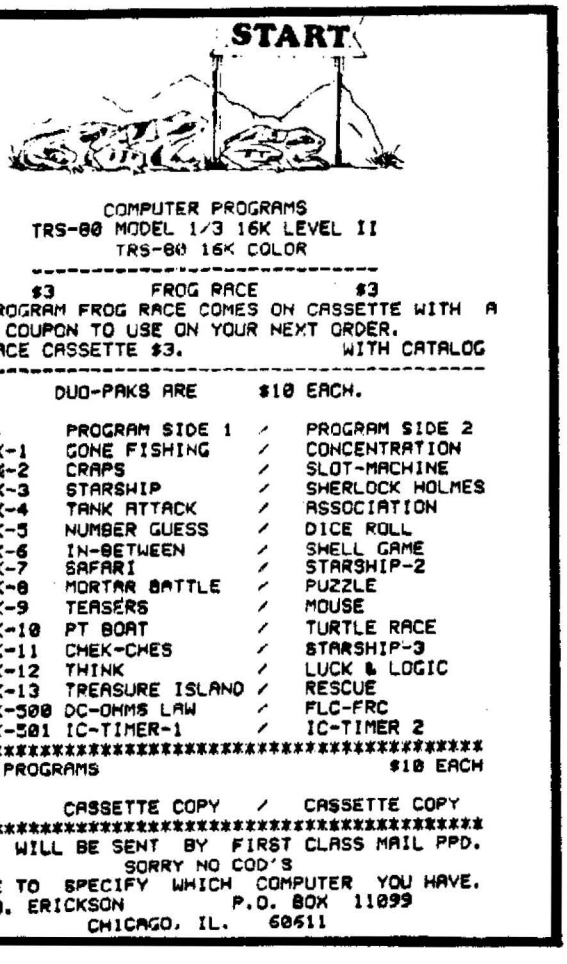
Contributions to *the RAINBOW* are welcome from everyone. We like to run a variety of programs which will be useful/helpful/-fun for other CoCo owners.

Program submissions must be on tape or disk and it is best to make several saves, at least one of them in ASCII format. We're sorry, but we do not have time to key in programs. All programs should be supported by some editorial commentary, explaining how the program works. We're much more interested in how your submission works and runs than how you developed it. Programs should be learning experiences.

We do pay for submissions, based on a number of criteria. Those wishing remuneration should *so state* when making submissions.

For the benefit of those who wish more detailed infor-mation on making submissions, please send a SASE to: Submissions Editor, *the RAINBOW*, P.O. Box 209, Prospect, KY 40059. We will send you some more comprehensive guidelines.

Please do not submit programs or articles currently submitted to another publication.



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PRINT #-2, *(continued from page 14)*

the *Seal.* And, while that's certainly *their* business, it seems to me that—judging from all the others who *do* use it, that publication is performing a disservice to both its readers and to its advertisers. We're not trying to "gain an advantage" with the *Seal,* we are just trying to help protect you.

From that standpoint, I would like to voice my appreciation to Bill Sias of *Color Computer News,* Larry Williams of *68 Micro Journal,* Wayne Green of *80-Micro and Hot CoCo,* and Mike Schmidt of *Basic Computing* (formerly *80-U.S. Journal)* for cooperating, unasked, in this consumer protection program. It, frankly, would have been easy for them (as one magazine has) to make up an excuse not to allow the use of the *Seal* in advertising in their publications. That *they* choose not to do so speaks well, I believe, for the kind of spirit of CoCo Community I write about here. It also speaks well for their interest in you, as a member of the CoCo Community, who may wish to use the *Seal* as a guide to purchases.

The results of our informal poll on reader service cards are in, and the result was overwhelming in opposition to them. The most-voiced comment was that if you were really interested in a product, you would write or call the vendor directly. Said one correspondent: "If I want to buy something, I call or write; if I want to get a lot of mail I'll use a reader service card. But I don't *buy* from a reader service card, it is just too slow."

By way of "finally," I'd like to introduce you to several new members of *the Rainbow's* staff.

I'm really pleased to be able to announce that Charlotte Ford has joined us as advertising manager. Charlotte brings a wealth of planning and organizational experience to *the Rainbow* and I am sure our advertisers will be pleased to have the opportunity to work with her.

We also have another new "member" of the ad staff, Jack Garland of John A. Garland and Associates. Jack and his staff will be representing *the Rainbow* and *PCM — The Portable Computing Magazine* in the eastern United States. He can be reached at P.O. Box 314, Duxbury, MA 02332 or by phone at (617) 934-6464. His firm has an excellent reputation in the computer field and will be assisting advertisers located east of the Mississippi River.

Also new to *the Rainbow* are Peggy Henry, who joins our art staff, and Susan Remini, who is the newest member of our editorial staff. Yes, we're growing. Thanks to you all.

—Lonnie Falk

Software Review

CoCo Goes CAD!

Are you into stubs? How about betas? Do you know what a mho is? No, these are not things worshipped by a new California cult, but are electronic terms used by *(gasp!)* non-digital electronics people.

These and many other strange sounding terms are used by engineers, ham radio operators, and hobbyists to describe the parameters of linear circuits they design (a linear circuit is one that has a linear voltage-current relationship). These circuits are usually designed by one of two methods.

The first method, and the one widely used by the hobbyist, is the cut-and-try method. This means building a circuit and physically measuring its performance. If it doesn't work right, then it is necessary to change one or more of the components and see if it performs any better. If it still doesn't work right, change some more parts and try again. You keep doing this until (if ever) the circuit performs correctly.

Obviously, this is not a very efficient method for circuit design, but most hobbyists don't have the tools needed for the second method which is *computer aided design* (CAD).

With the second method, parameters are fed into a computer program which does a series of complex mathematical studies of the circuit design and then tells the designer how the circuit will perform with the given parameters. If it's not right, the parameters are changed and the program gives new results. By the time the designer actually builds the circuit, odds are pretty good it will perform as expected.

What tools does the hobbyist/designer usually lack? Some don't know or understand the mathematics involved, others find it tedious to solve all the equations with paper and calculators and, until recently, very few have had access to computers to solve the equations.

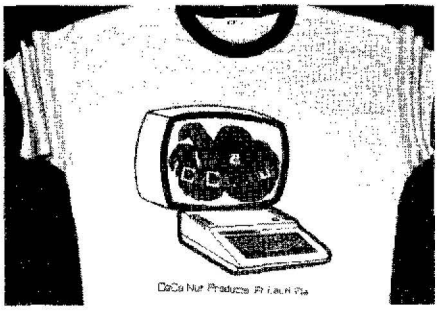
With the arrival of the home computer, the latter two groups now have the tools they need and, with the recent introduction of a program called *TNT-ALYZ,* the problems of the first group are being addressed.

TNT-ALYZ, from TNT Software, is a linear circuit analysis program written in Extended BASIC for a 32K, cassette-based CoCo. Its major features are

- menu driven commands
- built-in screen editor
- save and load circuit parameters (cassette only)
- list results to screen or printer

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— 30-day return policy

The use of *TNT-ALYZ* assumes you have some knowledge of circuit design. While the manual covers the use of the program and its limitations, it is not a tutorial on the subject.

The program will analyze a circuit containing 10 different common circuit elements (resistors, capacitors, inductors, bipolar transistors, field effect transistors, transformers, transmission lines, open stubs, shorted stubs, operational amplifiers).

A typical design session using *TNT-ALYZ* would run something like this:

Draw a diagram of the circuit to be considered, numbering all the nodes and picking component values.
Load and run *TNT-ALYZ*.
From the menu, pick #1, EDIT CIRCUIT.
Input each circuit element description and node numbers into the editor.
Back at the menu, pick #2, ANALYZE CIRCUIT.

The program now checks the information typed into the editor for gross errors. If no errors are found, a series of questions are asked: input and output nodes, start and stop frequency, plot output (if yes, skips next question), number of data points and log or linear scale, output to printer or screen. After a period of time, the requested information is displayed.

Now, the information can be analyzed to determine if the circuit is doing what it was designed to do. If it is, you can save the parameters to cassette. If you want to change a value or two, just re-enter the editor, change the values and re-analyze the circuit.

The manual included with this program is quite comprehensive, containing 12 sections and 28 pages. Besides giving the usual information about the system requirements, it describes the rather nice screen editor, the format for inputting the circuit element parameters, and a simple "getting started" example. It also describes the circuit models used for some of the more complex elements, including the transformer, FET, transistor, transmission lines and op amps.

The manual also describes a complex circuit and its analysis, showing all the results obtained. One of the most notable features of this manual is its description of the program's limitations. An explanation is given for the assumptions made and some general hints on how to correct for the limitations. The last item in the manual explains TNT Software's 30-day return policy; if you don't like the program you can return it for a full refund.

I ran a couple of circuits through this program including the examples from the manual and found it to perform very well. A few idiosyncracies of the program surfaced during its use.

While the editor and error checking parts of the program worked well, they can't detect typos if the format of the entry is correct. I managed to crash the program twice, once with a ?FC error and once with an ?I/O error. The manual does describe how to re-enter the program without losing the data you typed into the editor if the program crashes or you have to push the reset button. Be warned, you must type in the information carefully and make sure the nodes are defined correctly.

The complex circuit example, a two-pole, RC active filter, I ran took slightly over 10 mintues to be analyzed and the results displayed. This was with the speedup *POKE* active, which is an option from the menu, by the way. While this is substantially faster than I could have done by hand, be prepared to have a cup of coffee while waiting for the results, especially if you can't use the speedup *POKE*.

The graphics used to display the results are low resolution *SET, RESET* blocks and character on the text screen. This limits the details and frequency range of the plotted information. I wish TNT Software would have made better use of CoCo's graphics capabilities.

The equivalent circuit models used by this program are rather simplistic and ideal. They also assume small-signal characteristics, a medium frequency range, no losses and steady state conditions. These constraints limit the usefulness of this program. Most of these problems can be overcome by adding elements to correct the deficiencies of the circuit models, but this limits the number of real circuit elements you can use (10 nodes and 28 circuit elements, maximum).

Given the limitations and constraints, I would still recommend trying this program to any serious circuit designer, especially if you don't have a full fledged CAD system at your disposal. Besides, if you find *TNT-ALYZ* doesn't fill your needs you can always return it.

(TNT Software, Rt. 2 Box 76D, Manor, TX 78653, $29.95 cassette)

—C.L. Pilipauskas

NEW

Shifter

A talking "munch game" for 1 or 2 simultaneous players. Developed by MIT grad in machine language for incredible performance— at fastest speed, you can cross the screen in about 1 second. Shifting maze adds surprises. Players greet each other when meeting. Can select computer as opponent for 1 player.

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RECEIVED & CERTIFIED

The following products have been recently received by *the Rainbow*, examined by our magazine staff and approved for the *Rainbow Seal of Certification*, your assurance that we have seen the product and have ascertained that it is what it purports to be.

This month the *Seal of Certification* has been issued to:

Rubicon II, a 32K upgrade to **Across The Rubicon**, the Battle for the Huertgen Forrest during WWII. Objective: control American forces and win by capturing pillboxes, cities, and an airfield in under 20 turns. Ark Royal Games, P.O. Box 14806, Jacksonville, FL 32238, tape $24.95.

Tape Utility, a 16K versatile menu driven program, which permits the user to easily maintain, backup, and catalog both tape and disk programs. Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421, disk $24.95 plus $3 S/H.

Hidden Basic 1.0, a program written in an effort to protect BASIC programs while not affecting speed, ability or performance of any program. Once a program is modified (hidden) these commands will not function: CLOAD or CLOADM, CSAVE or CSAVEM, DEL, EDIT, EXEC, LIST or LLIST, MEM, TROFF or TRON. Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421, tape $19.95.

Fast Lane, a machine language space game. Objective: you must cross the space traffic lane, sneak aboard the ship transporting powerful weapons to the Empire, dodge the century robots and electrified walls, get the turbo laser gun and return to your ship. Every time you steal a weapon, the Empire adds a security measure to prevent more weapons from being stolen. Acesoft Computer Products, 1680 North Page Drive, Deltona, FL 32725, tape $24.95.

Cassette Controller, a 3 x 2 x 1½ inch box with a plug in cord and knob settings for Auto and Manual positions which when hooked up to your computer and cassette player allows you to hear cassettes from the cassette player without unplugging cables. Vidtron, 4418 E. Chapman, Suite 284, Orange, CA 92669, $25.

Stereo Composer, a 16K Extended BASIC music synthesizer which allows one to produce music with four-voice music compiler and a seven-octave range. It supports dotted and double-dotted notes, eighth, quarter and standard triplet notes, sixteenth and thirty-second notes. Music can be played at any tempo, can be modified as the music plays and can be hooked up to play on your home stereo system. Stereo composer also displays constant random kaleidoscope patterns to stereo music. Comes assembled with complete hardware and software, an instruction manual and a 15-page operating manual with examples for producing music. Speech Systems, 38 W. 255 Deerpath Road, Batavia, IL 60510, cassette or disk, $119.95.

Color Scribe, a 32K printing program that allows you to use both the upper and lower case features of your CoCo and provides the ability to print your letters or programs on a printer attached to the RS-232 I/O connector. It has change and search commands, and the ability to copy or move sentences or paragraphs to different locations within your file. Computerware, Box 668, Encinitas, CA 92024, disk $49.95.

LCINT32, Lower Case Interpreter, a 16K/32K machine language program that will enter lower case command words and also allows a single key-stroke pause function. You can also single step through listings as well as through disk directories. Jarb Software, 1636 D Avenue, Suite C, National City, CA 92050, tape $10.95.

SPDUMP, a screen dump routine of 360 bytes of relocatable machine language code. SP Software, 1012 Biltmore, Lynchburg, VA 24502, tape $16.

CONCPOLY, a 16K menu-driven program which draws and designs a variety of colorful patterns, suitable for dump to a printer. Includes examples and instructions. SP Software, 1012 Biltmore, Lynchburg, VA 24502, tape $8.

SIXFOURK, a 64K program which allows you to inspect RAM, move ROM to RAM and run it there, disable DISK or EXT BASIC, and make setups with graphics, program, strings, and USR in upper or lower RAM. Includes tutorials and instructions. SP Software, 1012 Biltmore, Lynchburg, VA 24502, tape $20.

Rotworld, a 64K program which displays a rotating color globe of the earth, including 20 frames of a PMODE1 globe which is loaded into 60K of RAM by a driver program, plus an instruction program. SP Software, 1012 Biltmore, Lynchburg, VA 24502, disk $25.

Program File, a 16K Extended BASIC program that will produce and maintain a file system of your cassette programs. The file may be listed to screen or printer. Owls Nest Software, P.O. Box 579, Ooltewah, TN 37363, tape $14.95.

3-D Tic-Tac-Toe, a 16K strategy game of tic-tac-toe played on four planes, each plane divided into a 4x4 grid. Objective: get four markers in a row on one plane, or four in a row with one marker on each plane. Oelrich Publications, 4040 N. Nashville Avenue, Chicago, IL 60634, tape $16.95.

Peek Copy, a 16K ML program to copy machine language tape programs, even most autostart. Displays start, end, execute addresses and memory. Allows you to change or insert machine code. Oregon Color Computer Systems, P.O. Box 11468, Eugene, OR 97440, tape $11.95.

The Talking Wizard, a 16K Extended BASIC talking version of the popular Wizard game. Objective: input any question and the Talking Wizard writes and speaks an amusing answer. Computer Island, 227 Hampton Green, Staten Island, NY 10312, tape $19.95.

Ghost, a 16K Extended BASIC educational spelling game for two to six players. Includes two skill levels for ages eight to adult. Computer Island, 227 Hampton Green, Staten Island, NY 10312, tape $11.95.

Music Drill, a 16K Extended BASIC music note game. Objective: You will hear a musical note and must identify it. Computer Island, 227 Hampton Green, Staten Island, NY 10312, tape $19.95.

Multiplication, a 16K Extended BASIC step-by-step tutorial for the skills needed in multiplication. Three skill levels. Computer Island, 227 Hampton Green, Staten Island, NY 10312, tape $14.95.

Long Division, a 16K Extended BASIC step-by-step tutorial for the skills needed in long division. Three skill levels. Computer Island, 227 Hampton Green, Staten Island, NY 10312, tape $14.95.

Vocabulary Builder I, II, III, three 32K Extended BASIC word knowledge programs with 200 questions, 1000 words in a four part, multiple-choice format. Level I—grades 3-5, Level 2—grades 6-8; Level 3—grades 9-12, Computer Island, 227 Hampton Green, Staten Island, NY 10312, tapes $19.95 each.

Mathfact, a 16K Extended BASIC educational math program with two skill levels. Includes addition, subtraction, multiplication and division. B5 Software, 1024 Bainbridge Place, Columbus, OH 43228, tape $16.95.

MSI Color Finance, a 32K budget program which will maintain all financial records with reports similar to those used in business where expense accounting is essential. Includes a 52-page manual. Delker Electronics, Radio Shack Dealer #D223, P.O. Box 897, Smyrna, TN 37167, disk $59.95.

Essential Mathematics, Level 3, Number Concepts— addition, subtraction, multiplication, division, and fractions, a 32K educational program that provides drill and practice on essential mathematical skills for grades 6.5-8. Includes lessons 30-39 and a 30-page ringbound instruction manual. Micro School Programs, Bertamax, Inc., 101 Nickerson, Suite 202, Seattle, WA 98109, disks $87.50.

Autodialer, a 16K Extended BASIC program that will dial your phone list at fast speeds accurately. Stores approximately 50 names and dialing is done by way of the pause plug from the cassette port of the computer. Soundworks Productions, 26 E. 7th Street, Patchoque, NY 11772, tape $24.95.

ELCIRCAN, an Electronic Circuit Analyzer, a 16K program that will test a circuit's performance over as many frequencies as you like, without manual calculations. Digital-Linear Systems Engineering, P.O. Box 754, National City, CA 92050, tape $34.95, disk $49.95.

Bugger, a 16K Extended BASIC high resolution graphics arcade style game with three skill levels. Objective: you are a little bug who has fallen into a web which is inhabited by six large spiders. Eat all the tidbits and avoid all the spiders in this maze. Mr. R's, 68 Kelly Road, S. Windsor, CT 06074, tape $14.95.

2FER, two 16K Extended BASIC games on one cassette. **Gondola**—Objective: pilot your balloon over the mountains and safely amongst the trees. Wind, gravity and mother nature are factors to consider. **Copy-Cat**—Objective: match the computer in a Simon-type game. Mr. R's, 68 Kelly Road, S. Windsor, CT 06074, tape $9.95.

Catacomb!, a 16K high resolution graphics space game. Objective: travel the hyperspace corridor to your mothership as you avoid enemy patrols while getting fuel for your escape from the Catacomb. Oregon Color Computer Systems, P.O. Box 11468, Eugene, OR 97440, tape $19.95.

SCORE-EZ, a 16K Extended BASIC dice game for up to six players. Objective: achieve the highest possible score based on the roll of five dice until you have completed your score card. Jarb Software, 1636 D Avenue, Suite C, National City, CA 92050, tape $15.95.

Beyond Words I, II, III, a three part 32K Extended BASIC menu-driven program with tutorials, grade-appropriate subtests and reviews. Contains 400 questions, 800 words and is modifiable. **Beyond Words I**—grades 3-5; **Beyond Words II**—grades 6-8; **Beyond Words III**—grades 9-12. Computer Island, 227 Hampton Green, Staten Island, NY 10312, tapes $19.95 each.

Kaleidophone, a 16K program which produces animated designs and pictures on your television screen in beat to music when it's connected to a stereo music source (Hi Fi, FM radio, cassette recorder, PA system, etc.) and to a Radio Shack Color Computer. Comes fully assembled and includes installation and operating instructions, KP-4 Kaleidophone, KP83 display system cassette and a reference manual. New Salem Research, West Main Street, New Salem, MA 01355, tape and hardware $49.95.

Ninja Warrior, a 16K arcade style game for one to six players with 16 skill levels. Objective: guide your Ninja through boulders, fire, pitfalls, flaming meteors, and Ninja masters to attain the ultimate achievement—Ninja Grandmaster. The Programmers Guild, P.O. Box 66, Peterborough, NH 03458, tape $29.95.

Math Facts Games I, a 32K educational program for practicing math. The program includes four games which can be played after correctly answering a math fact question. Includes three skill levels and a 15-page, ringbound instruction manual. Micro School Programs, Bertamax, Inc., 101 Nickerson, Suite 202, Seattle, WA 98109, disk $39.80.

Math Facts Games II, a 32K educational program for practicing math. This program includes four games which can be played after correctly answering a math fact question. Includes three skill levels and a 37-page ringbound instruction manual. Micro School Programs, Bertamax, Inc., 101 Nickerson, Suite 202, Seattle, WA 98109, disk $39.80.

Facts Match—Addition, a 32K educational program for ages six to eight, intended to help the user learn to recognize the word names and numerals for numbers 0-18 and the sums of the basic addition facts. Micro School Programs, Bertamax, Inc., 101 Nickerson, Suite 202, Seattle, WA 98109, disk $29.50.

Spelling in Context, Level 2, a 32K educational spelling program which provides the user the ability to learn and spell a word in the context of a sentence and the meaning of the word. Includes lessons 1-40 and a 34-page ringbound instruction manual. Micro School Programs, Bertamax, Inc., 101 Nickerson, Suite 202, Seattle, WA 98109, disk $49.50.

Number Match, a 32K educational program for ages four to six. This program enables the user to develop the concept of number, learn to count from one to nine, and to recognize the numerals for these numbers. Includes a 17-page ringbound instruction manual. Micro School Programs, Bertamax, Inc., 101 Nickerson, Suite 202, Seattle, WA 98109, disk $29.50.

Match and Spell, a 16K Extended BASIC educational program for one or two players, designed to build and improve spelling skills in a format similar to the television game of Concentration. Harmonycs, P.O. Box 1573, Salt Lake City, UT 84110, tape $11.95.

Spell Rite, a 32K Extended BASIC spelling verifier designed specifically for cassette operation, supports any word processor or text editor that generates ASCII tape files such as Color Scripsit, Telewriter-64, and Super Color Writer. Spell-Rite will verify a 1,000 word document in under nine minutes. Includes a 19-page user's manual, a 10,000-word dictionary with the ability to build multiple special purpose dictionaries, and an index generator that automatically sorts indexes in alphabetical order. Eigen Systems, Box 180006, Austin, TX 78718, tape $59.95.

Flash Cards, a 16K Extended BASIC program designed for ages six and up, uses attention-getting sounds, and repetition in order to reinforce items of study that can best be learned by memorization. Harmonycs, P.O. Box 1573, Salt Lake City, UT 84110, tape $11.95.

Tic Tac Toe Math, a 16K Extended BASIC educational game for ages four and up. Objective: improve basic math skills in addition, subtraction, multiplication and division in a tic tac toe game format. Harmonycs, P.O. Box 1573, Salt Lake City, UT 84110, tape $11.95.

THAT'S INTEREST-ing, a 16K Extended BASIC program that will help you deal with a number of problems requiring interest calculations. The present value and rate of return parts of the program allow the user to define all of the money flows in his problem. The bond yield and amoritization parts of the program use a question/answer sequence to guide the user through the problem. Custom Software Engineering, Inc., 807 Minutemen Causeway, Cocoa Beach, FL 32931, tape $29.95.

Jail, a 16K three-program tape where you can control the degree of difficulty. **Jail,** an educational game for one or two players. Objective: try to logically determine the given word. If you fail, then it's off to jail. Includes three word lists. **Scrambled Eggs**—Objective: given a word in a scrambled sequence, try to correct the order and hence determine the correct word. **Wordlist,** a program to enable the user to create word lists for Jail and Scrambled Eggs. Mr. R's, 68 Kelly Road, S. Windsor, CT 06074, tape $16.95.

Talking Speller, a 16K program which allows the teacher or parent to record a list of spelling words and play them back, by closely resembling a spelling test. Superior Graphic Software Projects, P.O. Box 451, Canton, NC 28716, tape $19.95.

The *Seal of Certification* program is open to all manufacturers of products for the TRS-80 Color Computer, the TDP-100, or the Dragon-32, regardless of whether they advertise in *the Rainbow*. By awarding a *Seal*, the magazine certifies the program *does exist*, but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to *the Rainbow's* reviewers for evaluation.

—Jutta Kapfhammer

CoCo Clubs

new clubs

Now a C.C. Users' Group in eastern Pennsylvania area. We have members from the Allentown, Bethlehem, Easton, Penn., and Phillipsburg, N.J., areas. For more information call Bill Jones at (215) 253-5733 or Jerry Behler at (215) 434-6387. Contact Jerry Behler, 1231 Walnut Street, Allentown, Penn., 18102, phone (215) 434-6387.

Jerry Behler

. . .

I would like to start a C.C. Club in and around Baton Rouge, La. Anyone interested can write to Gary Cash, 8929 Metairie Drive, Baton Rouge, La., 70810, or call (504) 293-7799.

Gary Cash

. . .

I'd like to inform all C.C. users in the Mississauga area of the Official 80C Club. Anyone interested in joining may write to 2422 Old Carriage Road, Mississauga, Ontario, Canada L5C 3G4.

Vincent Lok and Roland Hindel

. . .

Please help pass the word. The Indy C.C. Club meets in Indianapolis, Ind., the first and third Thursdays of each month. For more information, call Mike Davis at (317) 257-3300, or write: P.O. Box 68702, Indianapolis, Ind., 46268

Mike Davis

. . .

I'm looking for a group of people in the Edmonton, Alberta, Canada area who I can talk CoCo with and exchange programs and ideas. Contact John Gaudin, 5204-90 Ave, Edmonton, Alberta, Canada T6B ON9, phone 469-2012.

John Gaudin

I would like you to tell your readers about the Twin Cities C.C. Users' Group which currently meets the second and fourth Tuesdays each month. For information and location call Pat Moos at 533-5144, Bob Brose at 588-2116, or Bill Tyler at 698-8779. Or leave a message on the NC System Bulletin Board at 533-1957. No dues, no formality, lots of fun with CoCos.

Bill Tyler

. . .

Forming a C.C. Users' Group in the Simi, Westlake, Agoura, Woodland Hills, Thousand Oaks, Calif., area. If interested, please contact Bruce Rothermel, 3220 N. Medicine Bow Ct., Westlake Village, Calif., 91362, phone (805) 497-7268.

Bruce Rothermel

. . .

Broome County (New York State) now has an organized and fully-functioning users' group for C.C. owners. The club meets the first Thursday of each month at 7:15 p.m., NYSE&G Corp. Service Center, Old Vestal Road, Binghamton, N.Y. Each meeting consists of a brief business session followed by a planned program/demonstration and "chat" session. Membership is open to individuals or families at $12 per year. Contact Bucky Helmer, President, 57 Front Street, Binghamton, N.Y., 13905, phone 723-8223 or 724-5726.

Bucky Helmer

. . .

I would like to announce a new CoCo Club. The EBCCC (East Bay C.C. Club). We've met only once and are situated in the East San Francisco Bay area. The meetings are probably going to be in Oakland. It's not an official organization and so, to find out about it, log onto one of the BBSs and ask around. Call Datacom/80 (415) 895-8980 or Model I System/80 (415) 895-0699. Justin Paola, 2745 Stuart Street, Apt. #2, Berkeley, Calif., 94705.

Justin Paola

Co Community

We are compiling a list of Color Computer Clubs because of the many requests we have received. The CoCo Clubs may want to exchange newsletters, share ideas for topics of discussion at monthly meetings, etc.

Please let us know if we have omitted any clubs and send us complete, up-to-date addresses. Also, please notify us if you wish to add or delete any names on this list. Send your information to:

Color Computer Clubs
c/o Suzanne Kurowsky
the Rainbow
9529 U.S. Highway 42
P.O. Box 209
Prospect, KY 40059

ALABAMA

Joseph Bell, Jr., P.O. Box 335, Gardendale, AL 35071, phone (205) 631-3320 or 798-2355

Ed Rutledge, P.O. Box AK, University, AL 35486

ALASKA

Alaska C.C. Users' Group, Rick McDannel, 816 N. Pine, #2, Anchorage, AK 99504, phone (907) 274-5778

ARIZONA

Phoenix C.C. Club, 6619 W. Palo Verde Avenue, Glendale, AZ 85302, phone (602) 939-5666

Tucson 6809 C.C. Club, Michael A. Watts, 902 S. Kolb Road, Tucson, AZ 58711, phone (602) 747-8233

CALIFORNIA

L.A.C.C. Users Group, Mark Mooneyham, 2227 Canyon Road, Arcadia, CA 91006, phone (213) 355-6111

Joe Bennett, 1169 Florida Street, Imperial Beach, CA 92032, phone (619) 474-6213

Silicon Valley C.C. Club, Shawn Jipp, President, P.O. Box 61593, Sunnyvale, CA 94088, BBS (408) 733-6809 Serves Area

South Bay C.C. Club, Karen Schlotzhauer, 2545 W. 225th Place, Torrence, CA 90505, phone (213) 539-2439

COLORADO

Lowry Microcomputer Club/CoCo Users' Group, Chuck Hohn, Chairman, Lot D-71 LMHP, Lowry AFB, CO 80230

DISTRICT OF COLUMBIA

Jack Darling, P.O. Box 8827, Washington, D.C. 20003, phone (703) 780-6159

FLORIDA

Keys User Group, A.T. Woodland, P.O. Box 331, Islamorada, FL 33036, phone (305) 664-9230

William H. Brown, III, 2411 Hirsch Avenue, Jacksonville, FL 32216, phone 721-0282

Ernie Johnston, 1040 S.W. 61st Avenue, Margate, FL 33068

Dade County C.C. Users Group, George McVay, Miami, FL, phone (305) 274-8727

C.C. Club of Sarasota, Ernie Bontrager, 4047 Bee Ridge Road, Sarasota, FL 33582, phone (813) 921-7510

C.C. Users Group of South Florida, Suzanne Spahn, 11950 N.W. 29th Manor, Sunrise, FL 33323

GEORGIA

Roy Green, Atlanta, GA, phone (404) 953-6395

ILLINOIS

Shirley Elma, 12004 E. Kildare, Alsip, IL 60658

Ray Myers, 184 Southgate Estates, Bloomington, IL, phone (309) 828-4671

Richard L. Greer, 5461 S. Kenwood Avenue, Chicago, IL 60615

North County TRS-80 Computer Users Club, Dennis A. Church, 624 St. Louis Road, Collinsville, IL 62234, phone (618) 344-6284

John Sevcik, 1187 Fairwood Drive, Elgin, IL

No. Illinois C.C. Club, Robert Dooman, 3061 Knollwood, Glenview, IL 60025

No. Illinois C.C. Club, Dave Hooper, President, 4490 N. Mumford Drive, Hoffman Estates, IL 60195

So.Sub. CoCo, Bill Wright, P.O. Box 576, S. Holland, IL 60473

CoCo Users Group of Marissa, David Mercer, Secretary, 62 SN Bess, Marissa, IL 62257, phone (618) 295-2907

Rockford C.C. Club, John Picot, 724 Irving, Rockford, IL 61103, phone 963-9187

Quad City C.C. Club, John E. Grive, 4211 Seventh Avenue, Rock Island, IL 61201, phone (309) 786-8187

Motorola Microcomputer Club, Steve Adler, President, 1301 Algonquin Road, Schaumburg, IL 60196, phone (312) 576-3044

INDIANA

Indy C.C. Club, Mike Davie, P.O. Box 68702, Indianapolis, IN 46268, phone (317) 257-3300

Robert Carr, 1937 N. Emerson Avenue, Indianapolis, IN 46218

Andrew Thomas, 2804 E. 55th Place, Suite Q, Indianapolis, IN 46220

IOWA

S. P. Chapler, R.R. #6, The Woods, Iowa City, IA 52240

KENTUCKY

Roger Idstrom, 2603 Garden Lake Lane, Louisville, KY 40220, phone (502) 491-1853

Stephen Hess, 2820 Del Rio Place #27, Louisville, KY 40220

MASSACHUSETTS

New England C.C. Users Group, Christopher E. Sweet, P.O. Box 255, Harvard, MA 01451, phone (617) 456-8291

Jason Rahaim, Spring Street, Lunenburg, MA 01462

MICHIGAN

Greg Miller, P.O. Box 365, Haslett, MI

Midland C.C. Club, Neil Drake, 709 Coolidge, Midland, MI 48640, phone (517) 631-2939

John Herbert, 50211 Peggy Lane, New Baltimore, MI 48047, phone 949-4842

WOCCUG (Color), Mike Sussman, 5275 Langlewood Drive, Westbloomfield, MI 48033

MISSISSIPPI

Singing River C.C. Club, Jerry P. Lowe, Sr., 2500 Fairley Road, Gautier, MS 39553

MONTANA

Billings C.C. Club, Jayne Kenyon, 4306 Phillip, Billings, MT 59101

NEW JERSEY

Bryan McPhee, 418 Virginia Trail, Browns Mills, NJ 08015, phone (609) 893-5120

Bud Lavin, 73 B Wavecrest Avenue, Winfield, NJ 07036, phone (201) 925-1827

NEW YORK

C.C. Club of Central N.Y., Joseph Short, 248 S. Fourth Avenue, Ilion, NY 13357, phone (315) 895-7730

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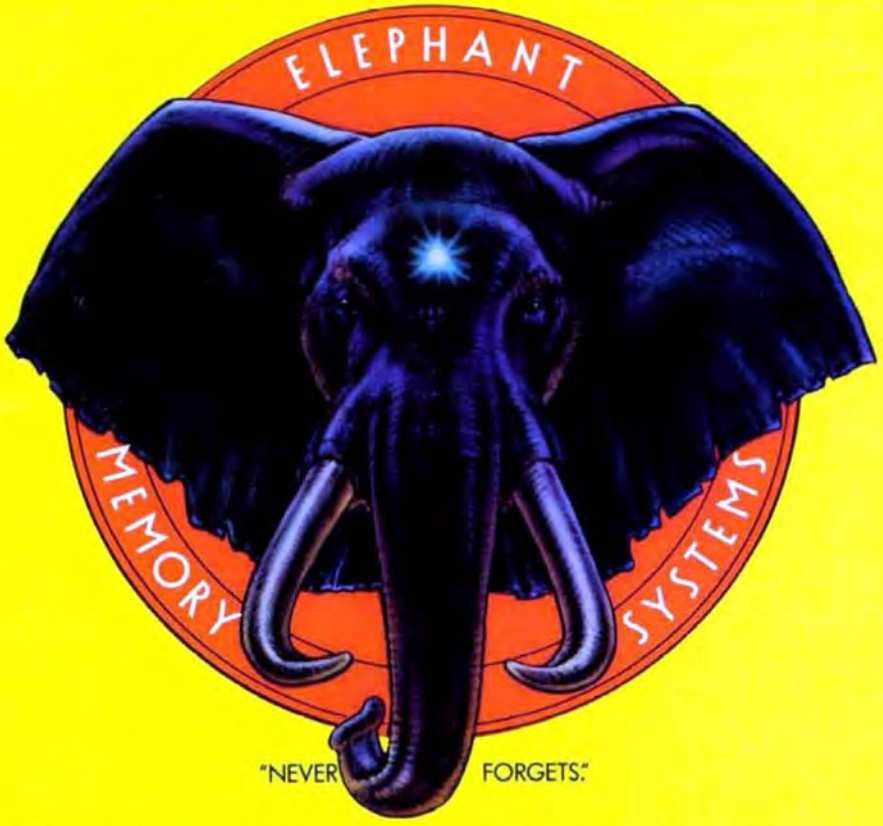
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